# AUTOMOTIVE INDUSTRIES

AUTOMOTIVE and AVIATION MANUFACTURING
ENGINEERING • PRODUCTION • MANAGEMENT

MAY 1, 1957

*In This Issue*



A CHILTON PUBLICATION

New from Standard Oil

# RYKON

GREASE

*Standard scores major breakthrough in grease technology to bring you better lubrication . . . help you make important savings in grease use, application and inventorying.*

Scientists at Standard Oil have developed a new non-soap, organic, grease thickening agent. This, plus other improvements in grease formulation, is now available in a new line of Standard greases named RYKON.

**Mechanical stability**—RYKON Greases show little change in consistency even under severe working.

**Oxidation stability**—Exclusive thickener in RYKON Greases inhibits oxygen absorption. This prevents costly corrosive action on bearings.

**Water resistance**—Extremely resistant to water washout.

**High temperature stability**—RYKON Greases have an ASTM dropping point of 480° F. They have exceptional heat stability.

**Resistance to change**—RYKON Greases remain soft and grease-like at sustained high temperatures, continue to give thorough lubrication.

**Low temperature stability**—RYKON Greases work readily at low temperatures, lubricate from a cold start.

**Oil separation**—RYKON Greases exhibit strong resistance to bleeding.

**Rust preventive properties**—RYKON Greases demonstrate superior natural qualities in prevention of rust.

To meet specific grease lubrication problems, greases in four Regular and three Heavy Duty grades are available. With a single RYKON multi-purpose grease doing all jobs in the plant, there's no wrong grease to use. Money invested in grease inventories is cut, storage and application facilities are reduced. Maintenance training is simplified.

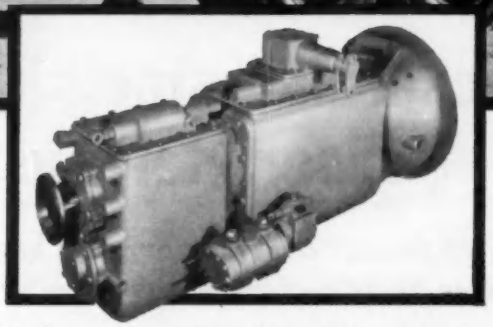
Get the facts about RYKON Greases from the industrial lubrication specialist at the Standard Oil office nearest you in any of the 15 Midwest and Rocky Mountain states. Or write Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD

**STANDARD OIL COMPANY**
(Indiana)

# Oil well fracturing... another new big job for COTTA HEAVY-DUTY TRANSMISSIONS

The newest of the new breed of diesel giants — trailer-mounted oil well fracturing rigs — produced by BJ Service, Inc., consists of a pair of 600 hp engines coupled to two 10,000 psi pumps through two Heavy-Duty Cotta Transmissions.



When big power moves into a new job, a Heavy-Duty Cotta Transmission is often the one best answer to speed-change problems.

That's what BJ Service, Inc., Long Beach, California, found in developing their biggest and newest version of the dieselized oil well fracturing unit. Fracturing, the operation in which a huge gallonage of liquid, mixed with sand, is injected into an ailing oil well to break the oil formation, requires near-explosive force. Big hydraulic horsepower is so much a requirement that as many as half a dozen giants like the one shown above may be combined to concentrate up to 5,000 hp on a single job.

Whether you have the problem of conveying the *greatest possible* horsepower to a given operation or just *big* horsepower, you can count on Cotta for the tough, smooth-operating transmission you need. Dependable Cotta transmissions and gear reducers are built by *specialists* in heavy-duty power problems. Cotta offers you a wide range of standard transmissions and reducers with input torque ranging from 150 to 2,000 ft lb... or design service on exactly the "engineered-to-order" unit your special job requires.

**THIS INFORMATION WILL HELP YOU**

Sent free on request — diagrams, capacity tables, dimensions, and complete specifications. State your problem — COTTA engineers will help you select the right unit for best performance. Write today.

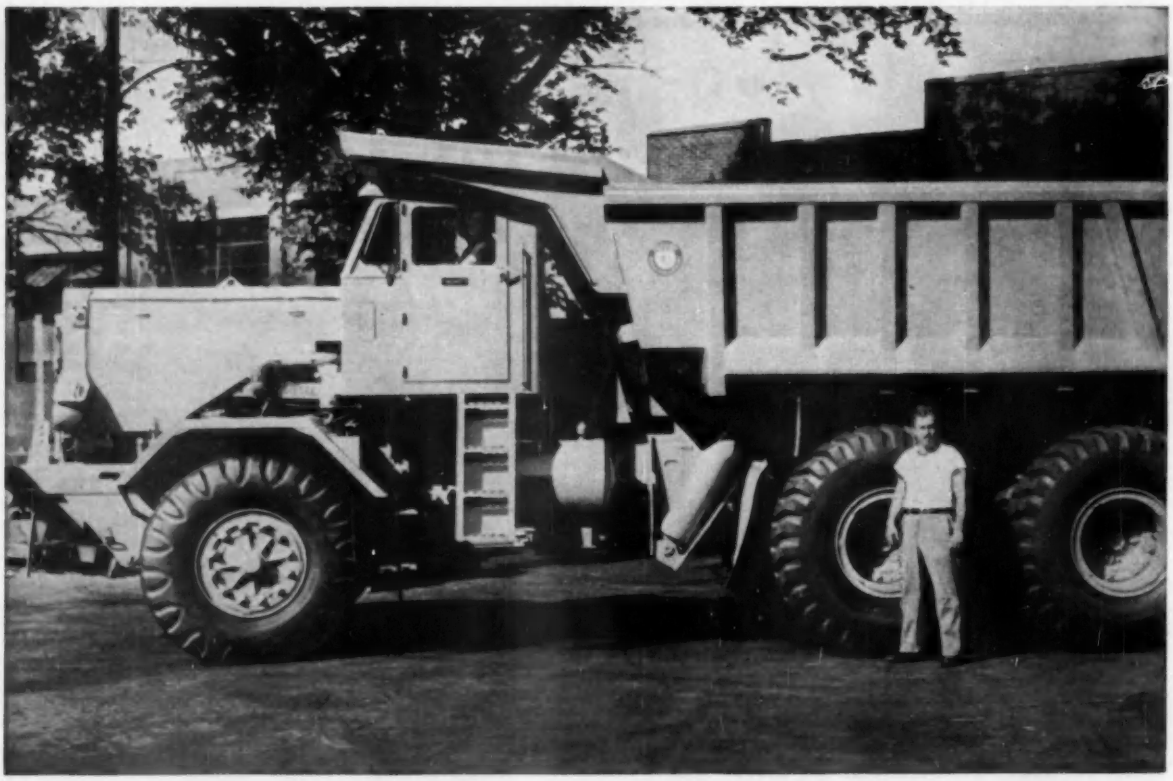
***COTTA TRANSMISSION CO., ROCKFORD, ILLINOIS***

An Assurance of Dependable Service

**COTTA**

**HEAVY-DUTY TRANSMISSIONS**

*"Engineered-to-order"*



## *Newest Dart 55-ton...*

# Nickel alloy steels lighten ore carrier axles, absorb terrific loads and impacts

### *"In 22 years," Dart metallurgists say, "we've found no stronger, tougher axle steels"*

This is a real bear cat . . . 55 tons, 25 cubic yards, 400 horsepower.

It's the latest of a long line of heavy-duty, high-capacity Dart trucks.

Like their first model built 22 years ago, it is designed for maximum load capacity and minimum tare weight. And like their first (many of which are *still* in service) its axle shafts are forged of 4340 nickel-chromium-molybdenum steel. They are heat-treated to a hardness of 400/440 Brinell, equivalent to tensile strengths ranging above 200,000 p.s.i.

The housings are alloy steel castings, of approximately Type 4335 composition, heat-treated to provide a minimum tensile strength of 100,000 and yield strength of 85,000 p.s.i.

Dart has never found another steel to equal the 4300 type for heavy-duty axles . . . and they've tried many. Here's what it gives them:

1. Dependable high strength that allows safe designing for low weight.
2. Toughness to resist bone-shaking impact under heavy loads and low operating temperatures.
3. Good machinability at high hardness.
4. Excellent hardenability.
5. Ready weldability along with high strength in cast housings.

**Light, strong, easy-to-fabricate.** This is the axle assembly for the Dart ore carrier. Housing contains a triple reduction power transmission; wheels, a double reduction carrier and single reduction planetary. To increase the strength/weight ratio and obtain top-notch casting and machining properties, Dart Truck Company, Kansas City, Mo. makes both shaft and housing of medium carbon nickel-chromium-molybdenum steels.

* * *

**Nickel alloy steels** are used for dependable trouble-free performance in the most demanding applications. Do you have such a problem in your equipment? Send us the details, we may be able to help you . . . write today.

INCO TRADE MARK **THE INTERNATIONAL NICKEL COMPANY, INC.** 67 Wall Street New York 5, N.Y.

# AUTOMOTIVE INDUSTRIES

A CHILTON MAGAZINE — PUBLISHED SEMI-MONTHLY

MAY 1, 1957 — VOL. 116, NO. 9


## FEATURES



## NEWS PREVIEWS



## DEPARTMENTS



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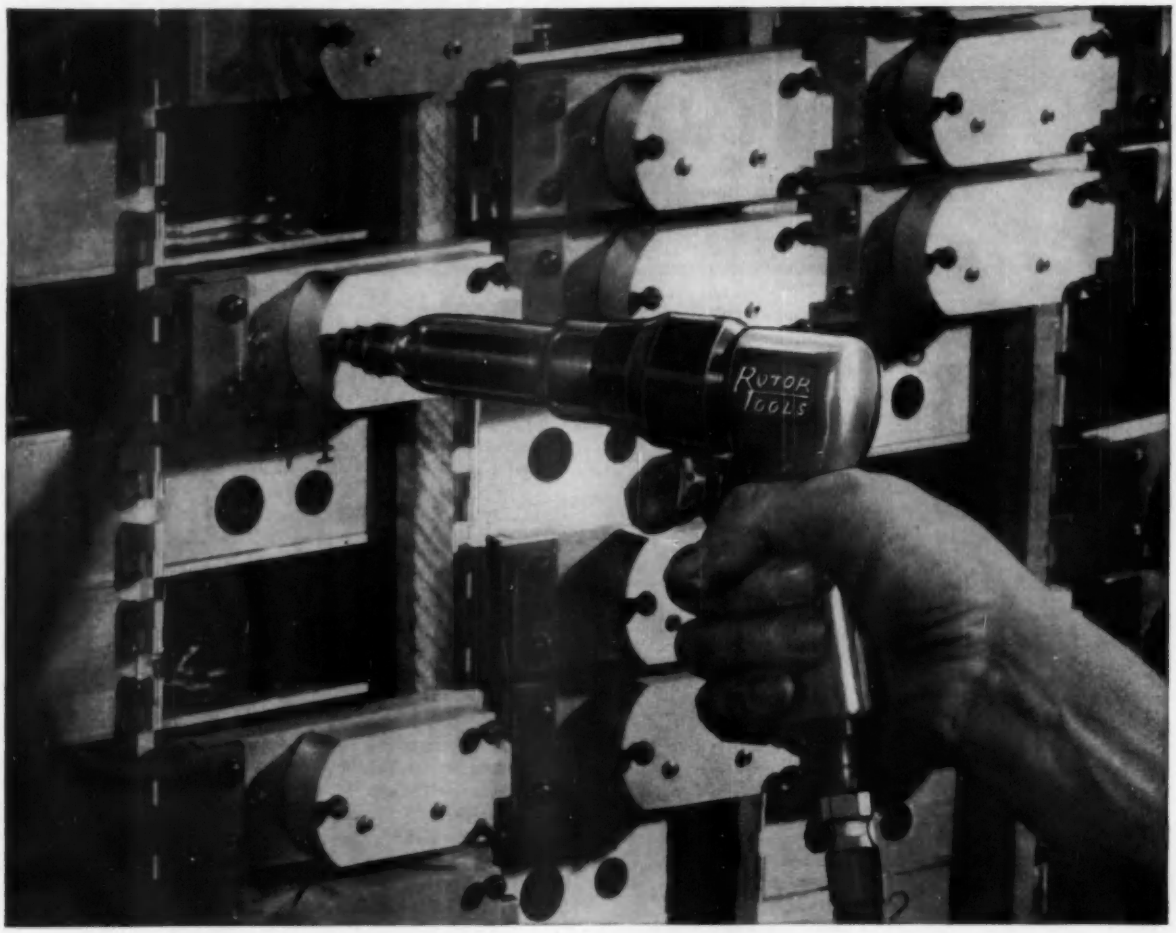



# Cuts screw-driving time 66%

**APPLICATION:** Rotor S-02 Air Screw Drivers on vault assembly job *paid for themselves in 8.6 weeks.* **RESULT:** Time per unit with former hand screw drivers was 13 seconds. With the 2000 rpm S-02 PRC, it is 4.4 seconds.

Rotor S-02 screw drivers and nut setters are available with three types of drives, with reversible or non-reversible motor, lever or pistol throttle, and with long or short angle head (with six different spindles). At least three speeds for each model. All models are quieter. Ask for a demonstration on your job. Bulletin 46 free on request. The ROTOR TOOL Company, Cleveland 32, Ohio.

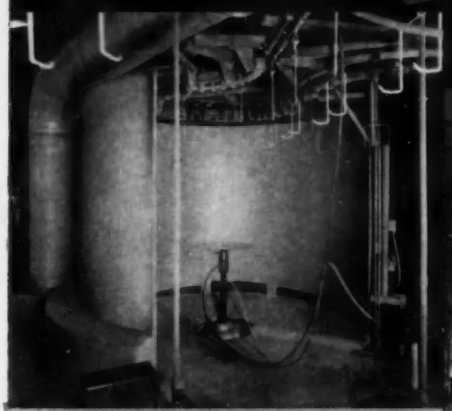
Here's the RIGHT TOOL for YOUR job!


**Rotor Air Tools:** Assembly Tools • Drills • Small Wheel Grinders
Straight Grinders • Vertical Grinders • Scalers • Chippers • Rammers
**Rotor High-Cycle Electric Tools:** Grinders • Polishers • Sanders

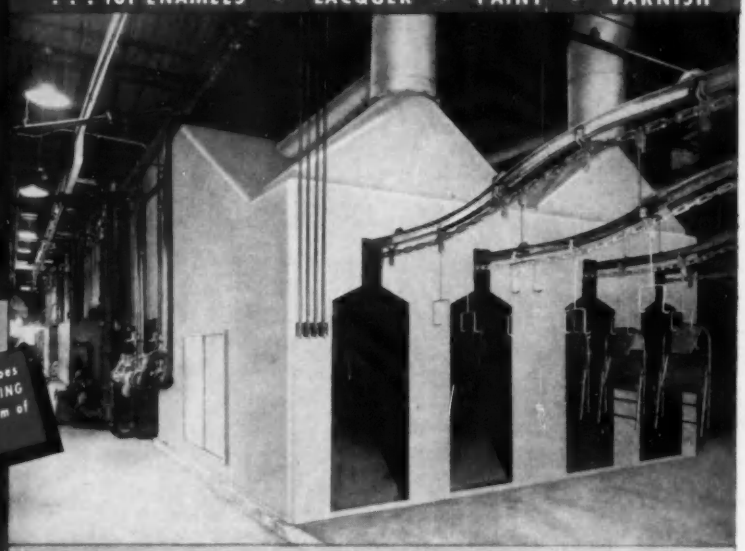
ROTOR TOOLS®
CLEVELAND, OHIO

# COMPLETE *Finishing* SYSTEMS

. . . for ENAMELS • LACQUER • PAINT • VARNISH



One of the Eight Mahon Ventilated, Circular Electro-Spray Enclosures Employed in the Four Separate Painting Facilities in this System. Note Provisions for Control of Air Movement.



Four-Production-Line Metal Cleaning and Surface Preparation Machine—Part of the Complete Mahon Finishing System in the Durham Manufacturing Corporation's Plant, Muncie, Indiana.


One of the Four Separate Painting Units in this System. Each of the Four Production Lines Passes through an Identical Arrangement —Two Electro-Spray Enclosures and Staggered Touch-up Booth.

Ramp-Tunnel to Finish Baking Oven on Roof. Both Ramp and Oven Accommodate Four Parallel Conveyor Lines in One Straight-through Pass. Equipment is Divided with Two Lines on Each Side. Either Side can be Operated Independently.

## *Complete NEW FINISHING SYSTEM Provides FLEXIBILITY and Greatly Increased PEAK PRODUCTION CAPACITY!*

A new and highly efficient Mahon Finishing System at Durham Manufacturing Corporation, Muncie, Indiana, gives management needed flexibility and greatly increased maximum painting production capacity. Four parallel painting production lines pass through the entire system. The Metal Cleaning and Surface Preparation Equipment, Dry-Off Oven, Cooling Tunnel and Finish Baking Oven are designed to accommodate four parallel conveyor lines. Each of the four conveyor production lines passes through one of four separate painting equipment arrangements—each of which includes two circular electro-spray enclosures and a staggered, touch-up Spray Booth. The entire System is designed so that two of the painting production lines can be shut down—the processing equipment is divided for this purpose. An ultramodern Finishing System of this type provides a manufacturer like Durham with painting equipment which will meet peak production demands and still permit operation at 50% capacity with the same efficiency and economy. If you are contemplating new finishing equipment, you, too, will want to discuss methods, equipment requirements and possible production layouts with Mahon engineers . . . you'll find them better qualified to advise you, and better qualified to do the all-important planning, engineering and coordinating of equipment. See Sweet's Plant Engineering File for information, or write for Catalogue A-657.

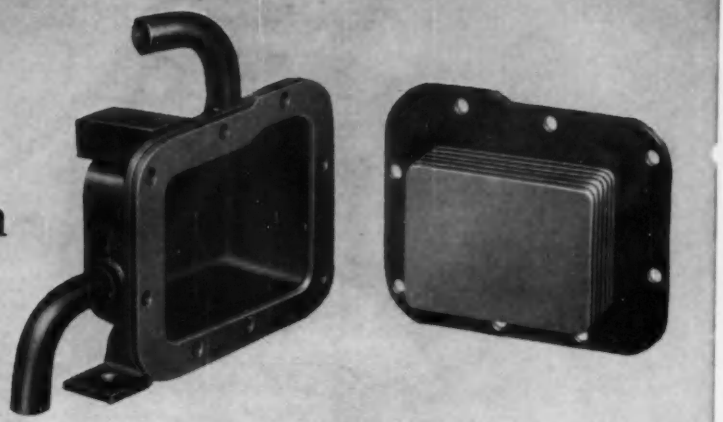
**THE R. C. MAHON COMPANY • Detroit 34, Michigan**

SALES-ENGINEERING OFFICES in DETROIT, NEW YORK and CHICAGO

Engineers and Manufacturers of Complete Finishing Systems—including Metal Cleaning, Pickling and Rust Proofing Equipment, Hydro-Filter Spray Booths, Dip and Flow Coaters, Filtered Air Supply Systems, Drying and Baking Ovens, Cooling Tunnels, Heat Treating and Quenching Equipment for Aluminum and Magnesium, and other Units of Special Production Equipment.

# MAHON

# Better Engine Operation with Oil Coolers



## *Heat dissipation in limited area accelerated by new, plate-type unit*

The ever higher performance being built into modern engines is creating new problems in heat dissipation. Engine efficiency, pressures and operating speeds have increased. So have operating temperatures of the engine parts. But the surfaces and area available for dissipating heat may be unchanged or even smaller. Therefore, more heat is drawn into the lubricating oil of the engine.

Although friction losses in percent of total power output are dropping, the absolute rate of heat generated has gone up. This heat may exceed temperatures which the bearings are designed to resist and may rise to destructive levels.

In commercial vehicle, marine and industrial engines, heavy work loads are usually frequent or constant enough to require an oil cooler to maintain viscosity and to augment heat rejection. Such a unit may be attached to the engine or built into the engine block.

### LARGE CAPACITY IN SMALL UNIT

To facilitate concentrated heat dissipation in a small space, Long Manufacturing Division of Borg-Warner Corporation has developed a compact, plate-type heat exchanger with large heat rejection capacity for its size. The unit is applicable on or in any engine requiring lubricant cooling. Current applications extend to 400 btu/pm. The element's rectangular shape is proportioned to be readily adaptable to a small aperature in the block where water can be circulated.

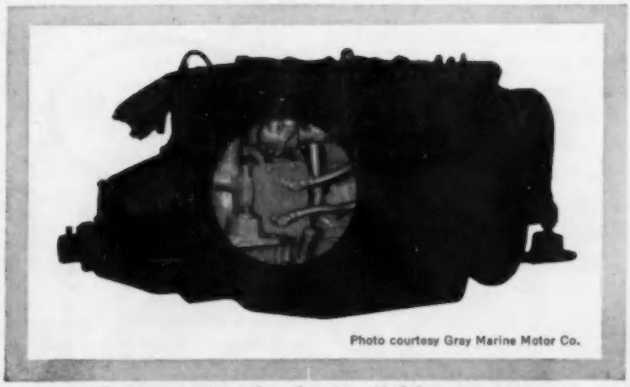


Photo courtesy Gray Marine Motor Co.

*The Long engine oil cooler, installed here on a new marine engine, is small, unobtrusive, easily accessible.*

It can also be used for any oil cooling application, such as in ttansmissions, torque converters and hydraulic presses.

The high efficiency of this cooling element lies in the diagonal flow path of the oil across the plates, utilizing the maximum possible length of the unit. Location of the fittings gives high velocity turbulence and effective oil distribution.

Spacers are placed between the plates to allow free circulation of the cooling water around this core. The assembly is then brazed into an integral structure. Counter-flow paths of the oil and water assure maximum heat exchange efficiency.

The turbulators are designed to minimize the pressure drop across the plates. Ingenuity in designing flow paths and stack arrangements of a single design element, according to the operating requirements, contributes to the economy of the unit. Any reasonable number of plates may be assembled in parallel, in series, and in parallel series.

### RUGGEDNESS AT LOW COST

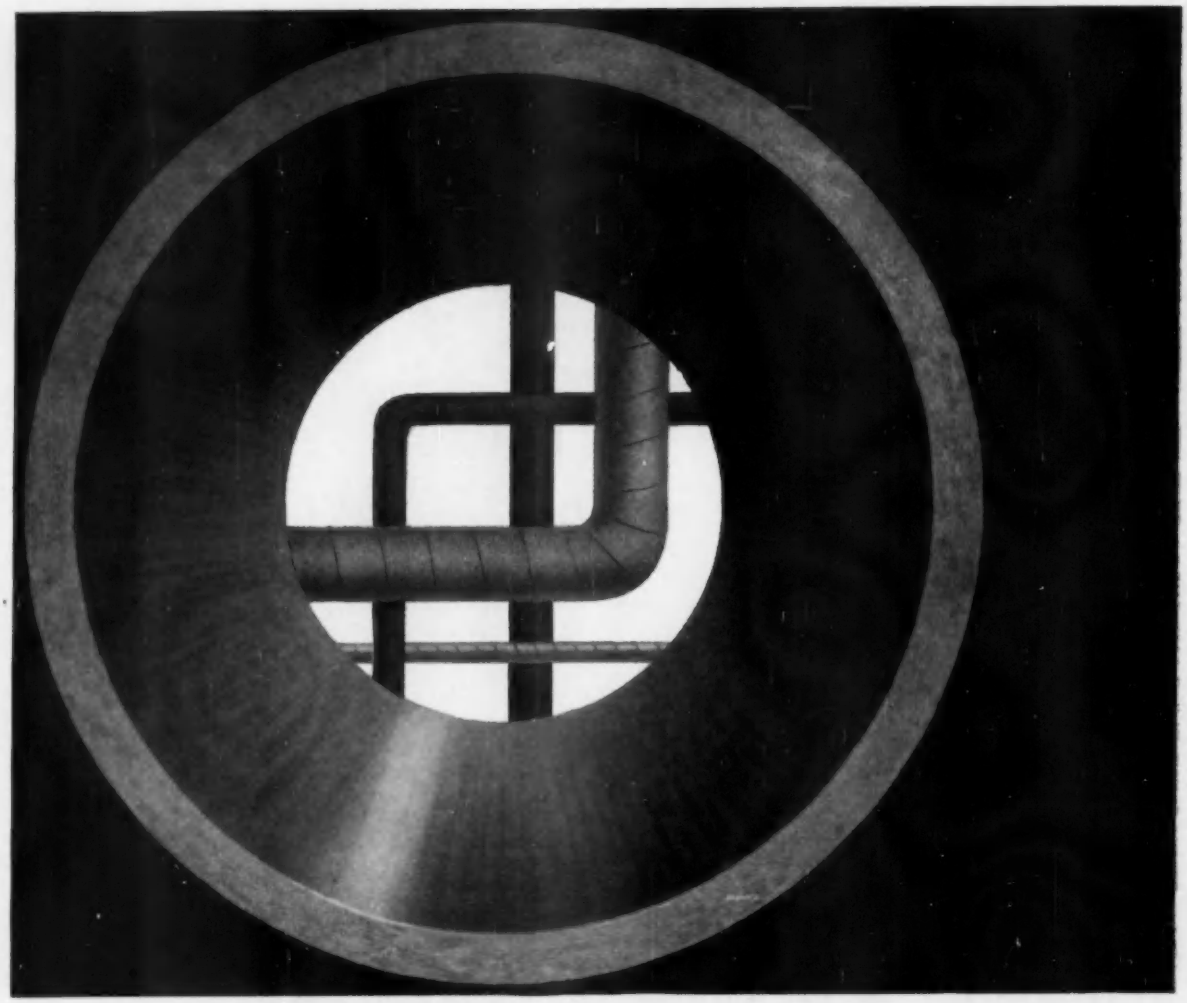
Manufacturing the casing (in accessory applications) from steel stampings instead of fabricating it from castings is a unique, cost and weight saving feature. Paint protects the exterior while the waterside is clad with rust- and corrosion-resistant cupronickel. The plate shells enclosing the mild steel turbulators are formed from stampings of solid cupronickel.

On the waterside this heat exchanger may be readily cleaned and the multiple-plate core can be removed from the casing without disturbing the water connections.

Traditional Long engineering and craftsmanship assures the quality, efficiency and dependability of this oil cooler. It is the first in a series of new products from this 53-year old manufacturer of heat exchangers, clutches and torque converters.

An engineering bulletin, including basic heat transfer and pressure drop charts from performance tests at Long Laboratories, may be had on request. The data also lists information requirements for obtaining recommendations on specific applications of this and other types of oil coolers.

Write to Dept. OC 1, Long Manufacturing Division, Borg-Warner Corp., 12501 Dequindre Street, Detroit 12, Michigan. In Canada: Long Manufacturing Company Limited, Oakville, Ontario. Export Sales: Borg-Warner International, 36 South Wabash Street, Chicago 3, Illinois.



# Enjay Butyl—*today's super-rubber*

## improves pipeline protection...cuts costs!

Plicoflex® Tape Coating, revolutionary new pipeline wrapping developed by Plicoflex, Inc., combines the outstanding protective properties of Enjay Butyl Rubber with the identification properties of a color-bearing plastic film to which the Butyl is laminated. Applied over an Enjay Butyl based primer and forming a permanent bond to the metal, the tape features: absolutely *no* moisture migration or penetration; exceptional resistance to shock-impact; excellent dielectric properties, and outstanding resistance to normal and unusual corrosive influences. This *cold-applied* wrapping is *safer* and *cheaper* to apply by hand or machine than hot coatings and requires fewer personnel.

This is still another in the steadily growing number of products developed with Enjay Butyl Rubber. Contact the Enjay Company for complete information about this truly *wonder* rubber . . . where it can help *you!* Complete laboratory facilities, fully staffed by trained technicians, are at your service.

ENJAY

*Pioneer in Petrochemicals*

**ENJAY COMPANY, INC., 15 West 51st Street, New York 19, N. Y.**

*Akron • Boston • Chicago • Los Angeles • New Orleans • Tulsa*

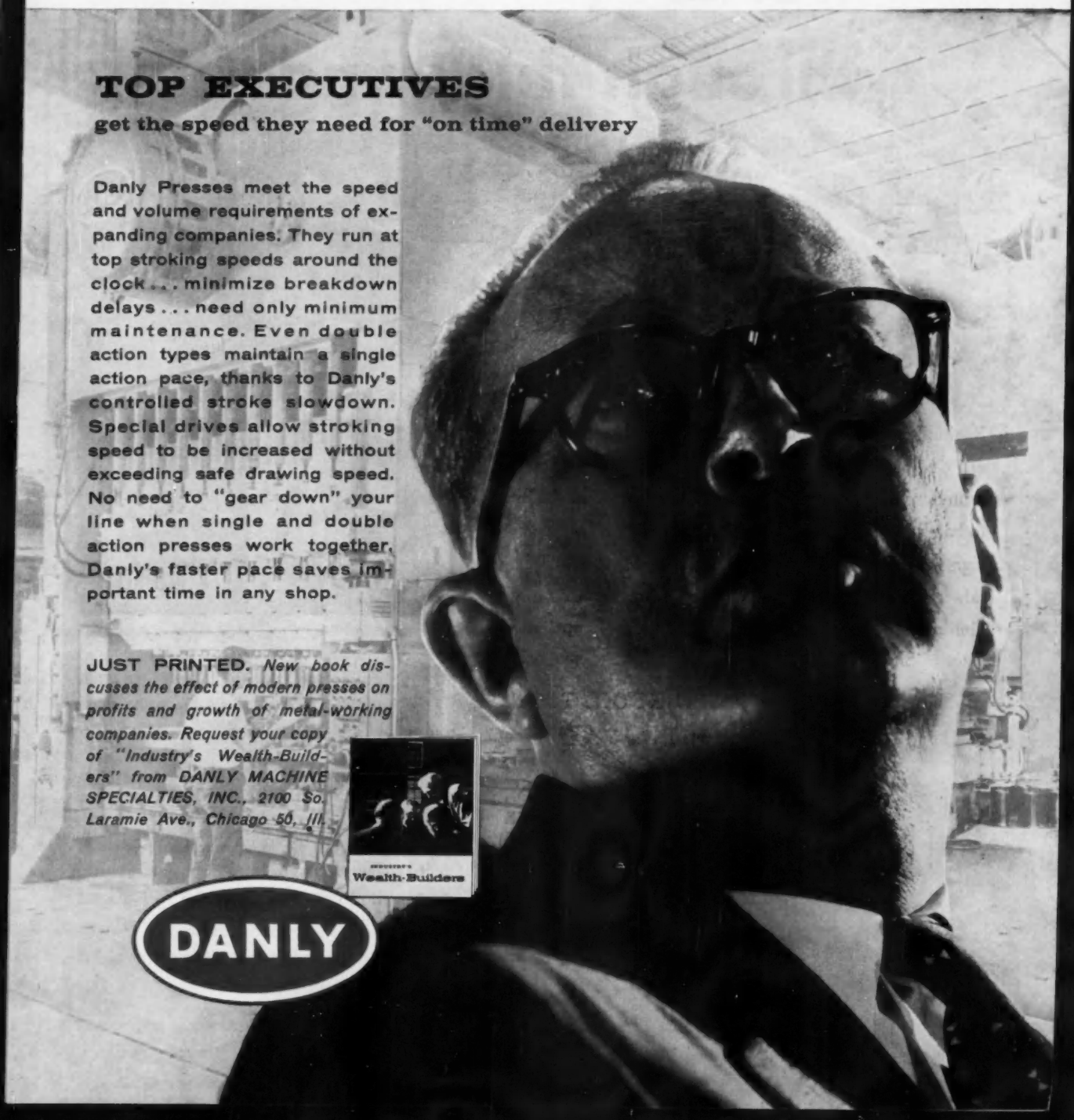
ENJAY BUTYL

Enjay Butyl is the super-durable rubber with *outstanding* resistance to aging • abrasion • tear • chipping • cracking • ozone and corona • chemicals • gases • heat • cold • sunlight • moisture.

**You get what you want with**

# DANLY

**PRESSES**



## TOP EXECUTIVES

**get the speed they need for "on time" delivery**

Danly Presses meet the speed and volume requirements of expanding companies. They run at top stroking speeds around the clock . . . minimize breakdown delays . . . need only minimum maintenance. Even double action types maintain a single action pace, thanks to Danly's controlled stroke slowdown. Special drives allow stroking speed to be increased without exceeding safe drawing speed. No need to "gear down" your line when single and double action presses work together. Danly's faster pace saves important time in any shop.

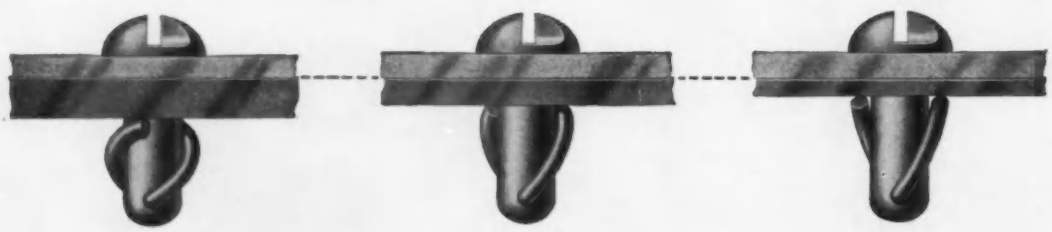
JUST PRINTED. *New book discusses the effect of modern presses on profits and growth of metal-working companies. Request your copy of "Industry's Wealth-Builders" from DANLY MACHINE SPECIALTIES, INC., 2100 So. Laramie Ave., Chicago 50, Ill.*




DANLY

# This fastener works through thick and thin!

**VISIT OUR EXHIBIT**
Booth 528
**1957 DESIGN ENGINEERING SHOW**
New York Coliseum, May 20-23



Spring-Lock—the easy-to-use removable fastener for modern designs—works whether panel thicknesses run over or under specifications! Spring wire deflects automatically to handle greater or lesser thicknesses. Spring-Lock's design flexibility makes it more than a fastener: it can be adapted as a shelf support, door strike, knob or any similar panel-mounted device. Many standard shapes and sizes of Simmons Spring-Locks are available from stock.

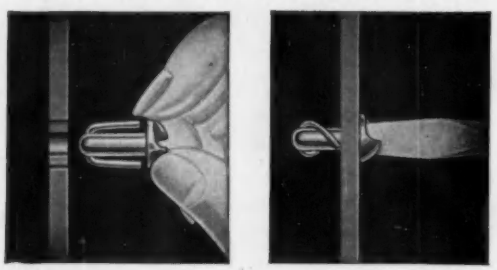
SIMMONS FASTENER CORPORATION
1749 North Broadway, Albany 1, New York

Simmons

QUICK-LOCK
SPRING-LOCK
ROTO-LOCK
LINK-LOCK
DUAL-LOCK

JUST OUT!
NEW 36-PAGE CATALOG WITH APPLICATIONS
SEND FOR IT!

**HERE'S HOW SPRING-LOCK WORKS**



**1.** *Insert fastener.* **2.** *Half-turn locks it in place.*

With production costs on the uptrend, you can figure on Spring-Lock as an assembly time and money-saver, because:

- **Installation is BLIND**
- **Installation is EASY: no special tools are needed**
- **Installation is QUICK: a half-turn locks it in place**
- **Installation is SECURE: the *spring* steel *locks* the fastener, resists vibration**

Send for details and samples, or write us about *your* fastening problem.

# This Inland Filler Strip

*provides positive leakproof protection!*

Inland Self-Sealing Strip assures a positive leakproof seal even under extreme conditions! Why? Because Inland's Filler Strip "zips" into a special locking channel after the glass is in place, putting greater pressure on fence and glass.

No matter what your sealing problem, whether it's glass or plastic, flat or curved, fixed or sliding window, Inland Strip requires no special mounting surfaces . . . channels . . . moldings or binders. It is a one-man installation . . . material, time and labor are reduced to a minimum.

Inland Self-Sealing Weather Strip is offered in a wide variety of standard shapes and sizes . . . or may be manufactured to your specifications. When you choose Inland Strip you are assured of a trouble-free permanently-sealed installation. Write for complete details.

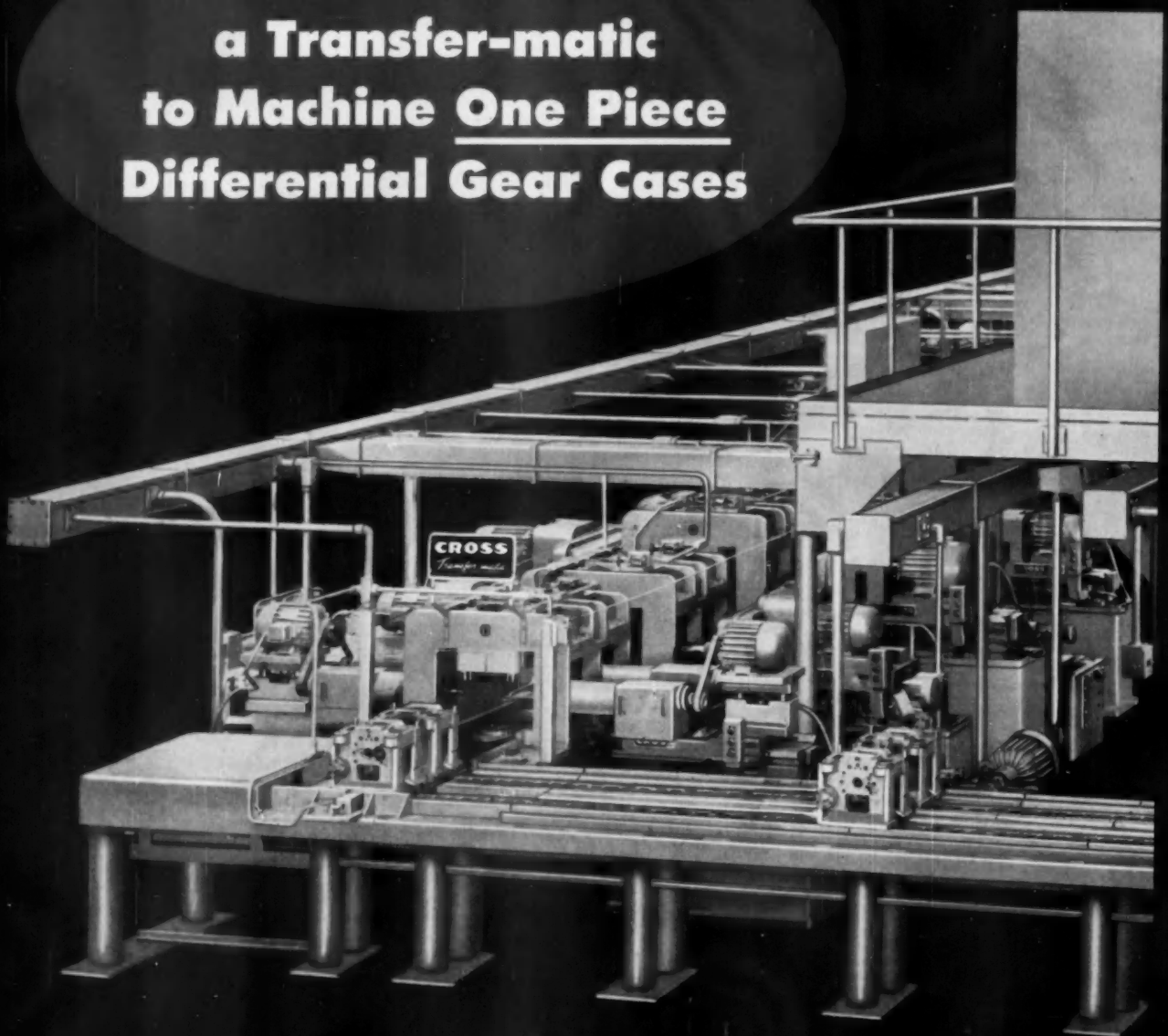
**INLAND**

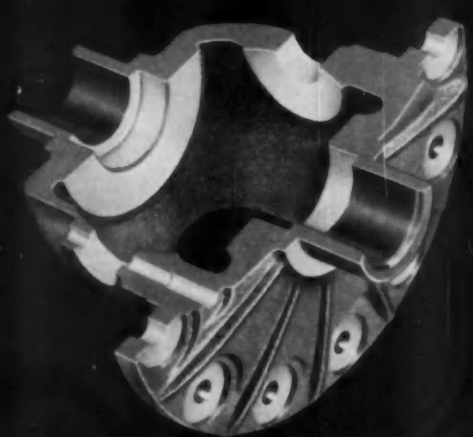
*self-sealing weather strip*

INLAND MANUFACTURING

INLAND MANUFACTURING DIVISION
General Motors Corporation, Dayton, Ohio

# Another Cross First – a Transfer-matic to Machine One Piece Differential Gear Cases



Cutaway view of differential gear case showing machined surfaces.

*Established 1898*

THE CROSS CO.

*First in Automation*

PARK GROVE STATION • DETROIT 5, MICHIGAN

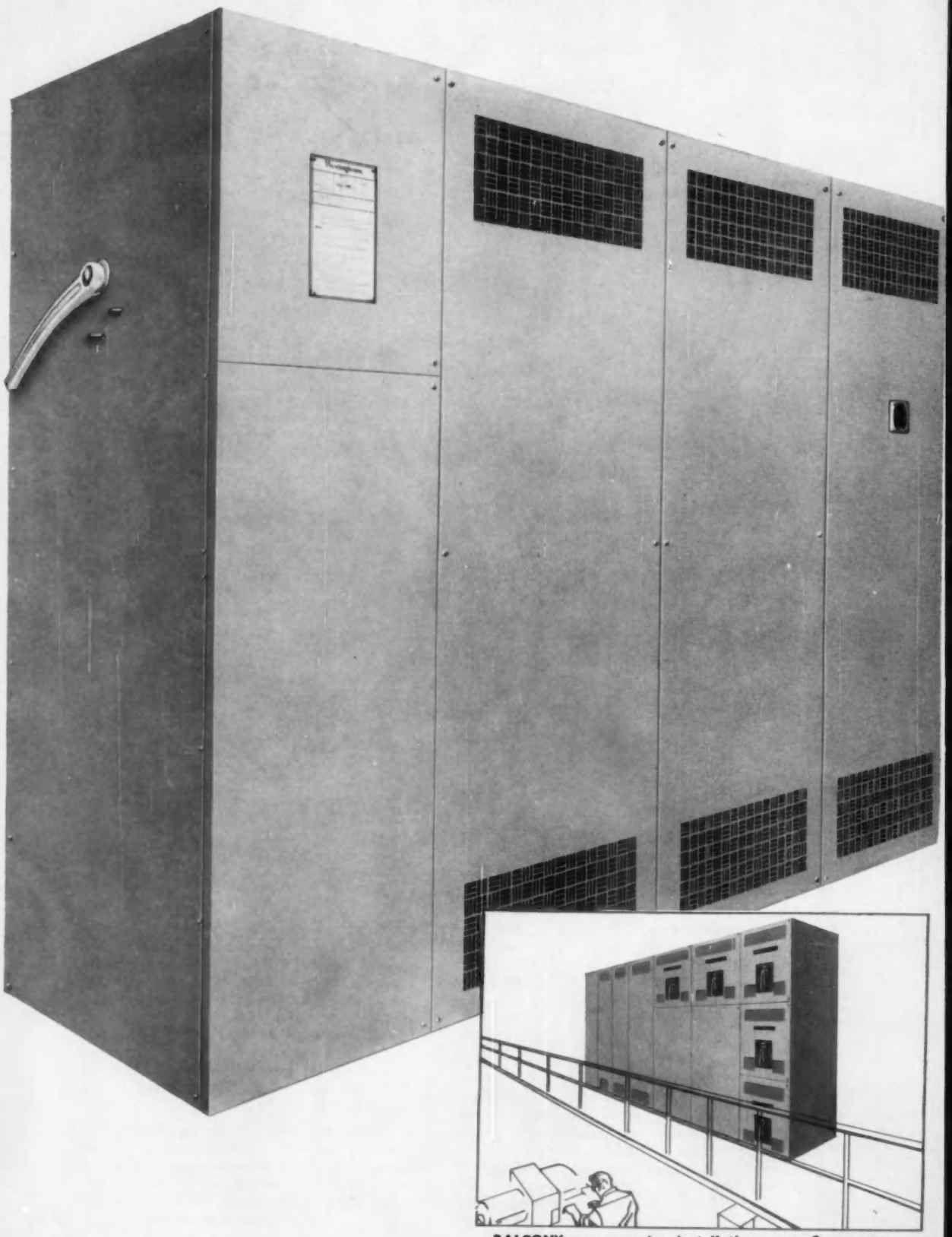
# *Another Transfer-matic by Cross*


**Here is another revolutionary development by Cross! A new Transfer-matic makes it possible to machine and inspect *one piece* rear axle differential gear cases—the first time such a part has been processed on a transfer machine.**

**Two cases are machined at a time as they travel a distance of 206 feet through 30 stations. Rated capacity is 212 pieces per hour at 100% efficiency. Operations include rough and finish forming the two spherical seats for the pinions; rough and finish boring and facing the two seats for the side gears; drilling, boring and reaming the pinion shaft hole; drilling and reaming the lock pin hole; drilling, chamfering, spotfacing and reaming the twelve ring gear mounting holes.**

**A unique feature is the arrangement for locating and clamping the pallet fixtures. In each station, elevators lift the fixtures from transfer bars into engagement with locating pins and stop buttons fixed in the overhead bridge structures. Individual wedges then back up the elevators to secure the pallets. After cutting, the elevators lower the pallets onto the transfer bars, which carry them to the next station.**

**Other features include construction to JIC Standards, hardened and ground ways, complete interchangeability of all standard and special parts, pre-set cutting tools and Cross Machine Control Units which program tool changes to reduce machine downtime.**

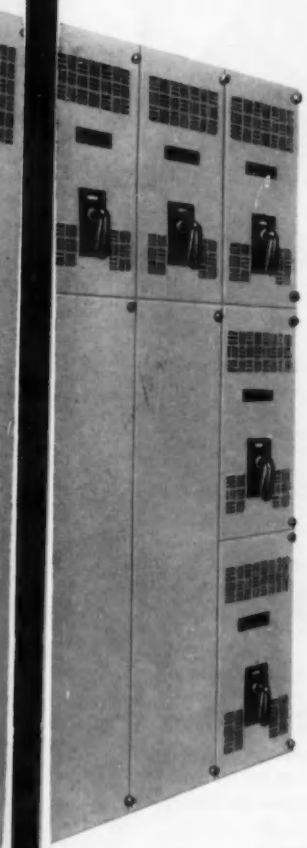


**BALCONY** or mezzanine installations save floor space, put power closer to load.

*Long bus runs are expensive*

*for utilization voltage*

# YOU'LL SAVE WITH POWER CENTER CLOSE TO LOAD



The cost of distributing power at utilization voltage in your plant can—and does—run into fancy red ink figures. Line losses multiply. Voltage drops. Motors run hot—heaters run cool—lighting efficiency fades.

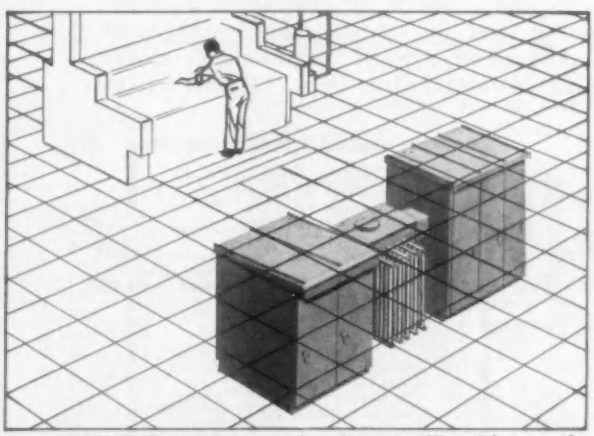
Westinghouse power centers can stop these losses and, depending on the size of your operation, the savings can pay for the initial investment in a surprisingly few months.

Westinghouse dry-type power centers are lighter. You can put them in the basement, put them on mezzanines—get closer to load, save space. They're packaged—transformer, breakers and associated equipment all factory assembled to specification—ready to set down and connect. They're simple to maintain—no liquids to reclaim, drain and replace. They're fire-safe—safer for personnel—more reliable for continuity and protection.

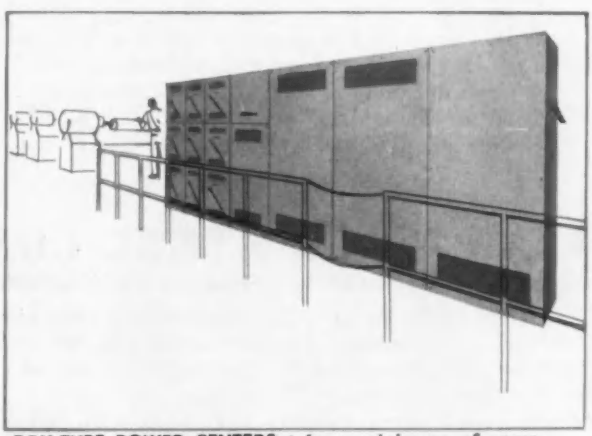
You can't afford not to expand or modernize your plant power distribution with power centers. Get the whole story from your Westinghouse sales representative—or your electrical contractor. Or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania, requesting *new* D. B. 34-150.

J-60902

**YOU CAN BE SURE...IF IT'S Westinghouse**



**BASEMENT** or underground vault may utilize either ventilated or sealed dry-type power center.



**DRY-TYPE POWER CENTERS** take a minimum of space even when placed in the middle of production areas.

# Why BUNDY Tubing Company uses A.W. Cold Rolled Steel

When 95% of today's cars use Bundy Tubing in an average of twenty applications, you can bet that the tubing must be right . . . and that the requirements placed on steel quality are exacting.

Bundy requires sheet steel that will meet tough demands of precision forming . . . provide top end-product performance over long miles of road wear . . . yet hold tubing production costs in line with vigorous competition.

Alan Wood produces and delivers cold rolled sheet to Bundy . . . and all other customers . . . on an "individual" order basis. Alan Wood's own metallurgists investigate the uses of customers' end-products and fabricating methods —then control the production of steel for each customer through each step—from mine to mill.

As a result, customers have steel to exact specifications. Production down time is minimized and rejects due to sub-standard material are cut . . . all of which helps improve customers' profits!

If your product requires uniform, high-quality steel, investigate the advantages of Alan Wood services and integrated production. Write Marketing Div., Dept. CR-S62, today.

**ALAN WOOD STEEL COMPANY**

*steelmasters for more than a century and a quarter • CONSHOHOCKEN, PA.*

DISTRICT OFFICES AND REPRESENTATIVES: Philadelphia New York • Los Angeles • Atlanta • Boston • Buffalo • Cincinnati Cleveland • Detroit • Houston • Pittsburgh • Richmond • St. Paul San Francisco • Seattle

Montreal and Toronto, Canada—A. C. Leslie & Co., Limited

IRON PRODUCTS
"Swede" *pig iron*

STEEL PRODUCTS
*Plates (sheared)*
*A.W. Dynalloy (high strength steel)*
*Hot rolled sheets*
*Hot rolled strip*
*Cold rolled sheets*
*Cold rolled strip*

ROLLED STEEL FLOOR PLATE
A.W. ALGRIP *abrasive*
A.W. SUPER-DIAMOND *pattern*

COAL CHEMICALS

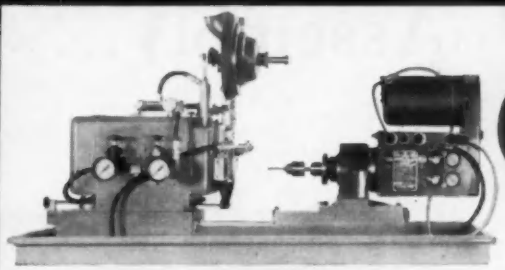
A.W. CUT NAILS
*Standard & Hardened*

MINE PRODUCTS
*Iron ore concentrates*
*Iron powder*
*Crushed stone*
*Sand*

COKE
*Foundry, industrial & metallurgical*

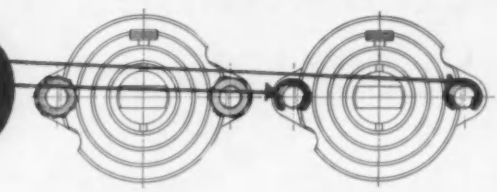
PENCO METAL PRODUCTS DIVISION
*Steel cabinets, lockers & shelving*

# Waldes Truarc Retaining Rings Eliminate Machining and Parts—Cut Assembly Time on Drill and Tapper



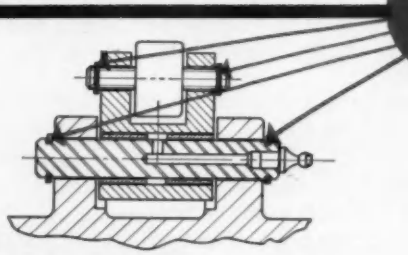
## Beco Model 410 Drill and Tapper

The Batchelder Engineering Co., Inc., Springfield, Vermont uses 4 different sizes of 2 different type Waldes Truarc rings in their new BECO Model 410 Automatic Drill and Tapper. Truarc rings speed assembly, reduce machining, improve design.



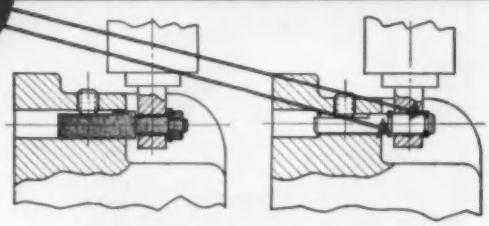

## Clamp Cylinder Rod Stop Assembly

Truarc "E" Rings (Series 5133) replace stop nuts in the Clamp Cylinder assembly. They eliminate need for threading 2 rods ...the danger of cross-threading nuts...and costly rejects. Truarc Rings cut assembly time and cost.



## Bell Crank Pivot Assembly

Truarc Rings (Series 5100) in Bell Crank Pivot assembly permit grease hole not possible with cotter pin fastener. Use of nuts would have increased machining and assembly costs considerably.




## Hopper Cylinder Anchor Pin Assembly

2 Truarc Rings (Series 5100) secure and position end of vertical air cylinder. Rings eliminate extra cost of machining 3-diameter pin, threading and undercutting...plus nut and washer. Assembly is quick and sure.

**Whatever you make,** there's a Waldes Truarc Retaining Ring designed to improve your product... to save you material, machining and labor costs. They're quick and easy to assemble and disassemble, and they do a better job of holding parts together. Truarc rings are precision engineered and precision made, quality controlled from raw material to finished ring.

**36 functionally different types**...as many as 97 different sizes within a type...5 metal specifications and 14 different finishes. Truarc rings are available from 90 stocking points throughout the U. S. A. and Canada.

**More than 30** engineering-minded factory representatives and 700 field men are available to you on call. Send us your blueprints today...let our Truarc engineers help you solve design, assembly and production problems...without obligation.

For precision internal grooving and undercutting...Waldes Truarc Grooving Tool!

**WALDES**

# TRUARC®

**RETAINING RINGS**

**WALDES KOHINOOR, INC.**
**47-16 AUSTEL PLACE, L. I. C. 1, N. Y.**

See the Truarc Exhibit at the Design Engineering Show, Booth 1910, New York Coliseum, May 20th to May 23rd.

Waldes Kohinoor, Inc., 47-16 Austel Place, L. I. C. 1, N.Y.
Please send the new supplement No. 1 which brings Truarc Catalog RR 9-52 up to date.
*(Please print)*

*Name* _____
*Title* _____
*Company* _____
*Business Address* _____
*City* _____ *Zone* *State* _____

AY 039

WALDES TRUARC Retaining Rings, Grooving Tools, Pliers, Applicators and Dispensers are protected by one or more of the following U. S. Patents: 2,382,948; 2,411,426; 2,411,761; 2,416,852; 2,420,921; 2,428,341; 2,439,785; 2,441,846; 2,455,165; 2,483,379; 2,483,380; 2,483,383; 2,487,802; 2,487,803; 2,491,306; 2,491,310; 2,509,081; 2,544,631; 2,546,616; 2,547,263; 2,558,704; 2,574,034; 2,577,319; 2,595,787, and other U. S. Patents pending. Equal patent protection established in foreign countries.

# For a Contact– or a Complete Sub-Assembly... See Mallory

Mallory offers you the savings and convenience of a single source for a simple contact —or a complete contact sub-assembly.

As Mallory has done for many manufacturers, we can consult with your engineers on a contact problem—solve the problem—design the contact element for easy inclusion in an assembly—and, if you want, build the entire sub-assembly for you.

Into this service goes all of Mallory's long experience in the contact field. Mallory metallurgy has equipped them with the best of materials and know-how, for the contact itself—for the backing metal—for design of the housing and for assembly techniques.

The pictured assembly was designed in cooperation with a leading electrical equipment manufacturer. The contacts, conductors, terminal points and the molded plastic case are all cooperative products of Mallory and the customer's engineering and manufacturing abilities. The contact material, Mallory D-54®, permitted the customer's product to pass Navy tests—and at the same time reduced costs by 15%.

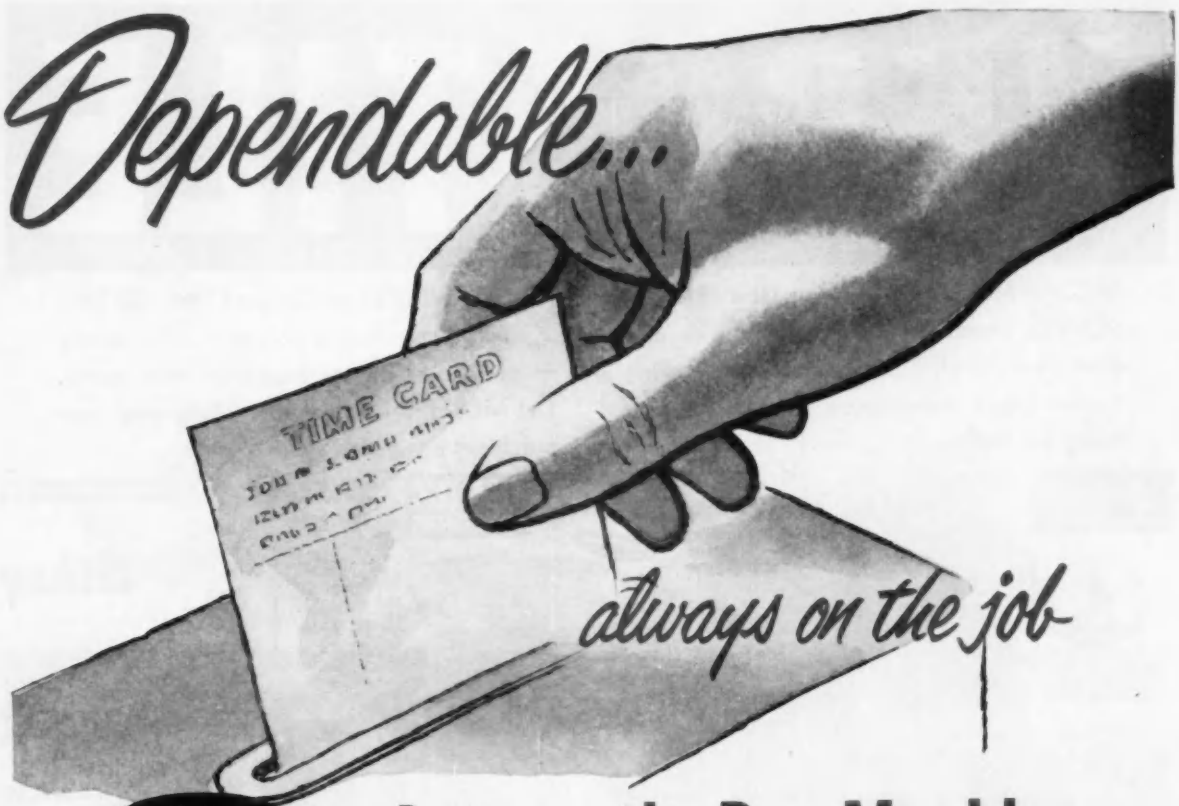
So if yours is a contact problem—or a complete contact sub-assembly problem—bring it to Mallory. A single source can expedite your supply and minimize your scheduling problems. Write, or contact the Mallory representative—today, for literature or a consultation.

***Expect more...get more from***

P.R. MALLORY & CO. Inc.
**MALLORY**
P. R. MALLORY & CO. Inc., INDIANAPOLIS 6, INDIANA

**Serving Industry with These Products:**

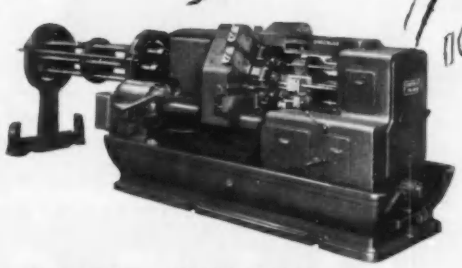
**Electromechanical** — Resistors • Switches • Tuning Devices • Vibrators
**Electrochemical** — Capacitors • Mercury and Zinc-Carbon Batteries
**Metallurgical** — Contacts • Special Metals • Welding Materials




PRODUCTION MACHINERY

GREENLEE

# Automatic Bar Machines



## SIX AND FOUR-SPINDLE AUTOMATIC BAR MACHINES

**GREENLEE Special Machine Tools**

- Multiple-Spindle Drilling and Tapping Machines
- Transfer-Type Processing Machines
- Hydro-Borer Precision Boring Machines

## BOOST PRODUCTION REDUCE DOWN TIME

It's easy to maintain rigid production schedules . . . prevent costly bottlenecks with Greenlee Bar Automatics. They are always on the job . . . give continuous, reliable service.

You hear much comment about Greenlees' uninterrupted, round-the-clock performance in widely different industries. With good reason, too, for Greenlee offers years of manufacturing experience... plus manufacturing integrity not often duplicated.

Want complete information? Call in the Greenlee man. Let him give you the complete story. Please submit a print when inquiring about a specific job.

WRITE FOR CATALOG No. A-405

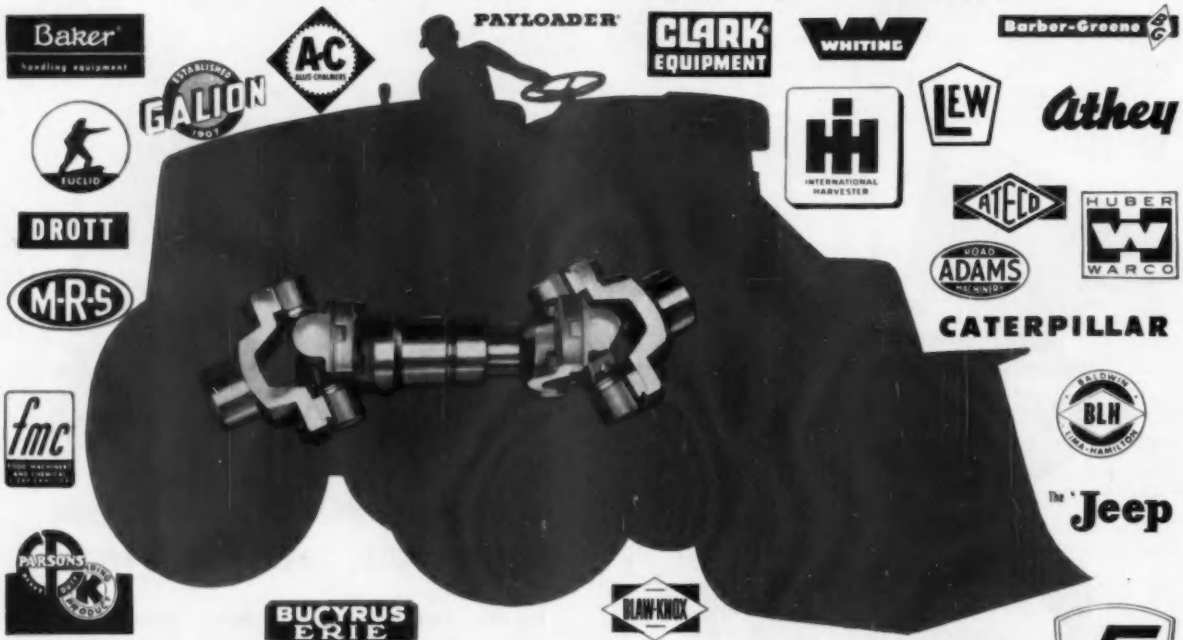
**GREENLEE BROS. & CO.**

**1755 MASON AVENUE**
**ROCKFORD, ILLINOIS**

# VERSATILE

MECHANICS Roller Bearing UNIVERSAL JOINTS excell for both main drives and controls — in all kinds of material handling trucks. Have transmission flanges for any type of brake drum. Easy to service —

MECHANICS Close-Coupled UNIVERSAL JOINTS transmit more power — in less space — at greater angles than any other joints. Let MECHANICS engineers help give *your* machines competitive advantages.




**MECHANICS UNIVERSAL JOINT DIVISION**
Borg-Warner • 2024 Harrison Ave., Rockford, Ill.
Export Sales: Borg-Warner International
79 E. Adams, Chicago 3, Illinois

# MECHANICS

## *Roller Bearing* UNIVERSAL JOINTS

For Cars • Trucks • Tractors • Farm Implements • Road Machinery • Aircraft • Tanks • Busses and Industrial Equipment

# BENDIX-WESTINGHOUSE AIR BRAKES
## Best buy for your trucks because they're preferred by America's leading fleet operators!



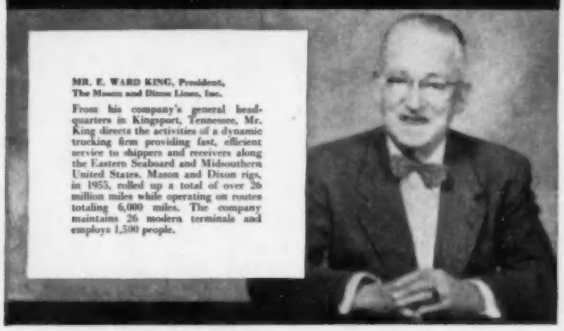
"In our 24 years in business

**We've bought 1,135 trucks**

AND WHEN IT COMES TO AIR BRAKES, WE PREFER

**Bendix-Westinghouse!"**

THE WORLD'S MOST TRIED AND TRUSTED AIR BRAKES



MR. E. WARD KING, President,
The Mason and Dixon Lines, Inc.

From his company's general headquarters in Kingsport, Tennessee, Mr. King directs the activities of a dynamic trucking firm providing fast, efficient service to shippers and receivers along the Eastern Seaboard and Midsouthern United States. Mason and Dixon rigs, in 1955, rolled up a total of over 26 million miles while operating on routes totaling 6,000 miles. The company maintains 26 modern terminals and employs 1,500 people.

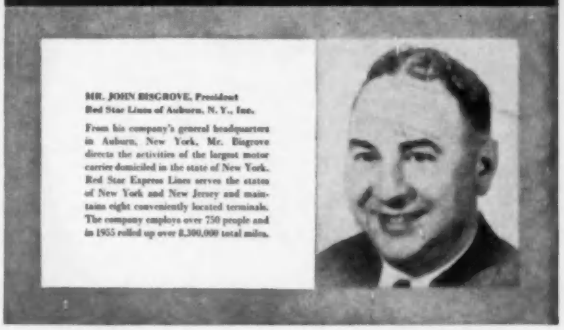
"IN OUR 24 YEARS OF BUSINESS

**We've bought 1,000 trucks**

AND WHEN IT COMES TO AIR BRAKES, WE PREFER

**Bendix-Westinghouse!"**

THE WORLD'S MOST TRIED AND TRUSTED AIR BRAKES



MR. JOHN BISGROVE, President
Red Star Lines of Auburn, N. Y., Inc.

From his company's general headquarters in Auburn, New York, Mr. Bisgrove directs the activities of the largest motor carrier domiciled in the state of New York. Red Star Express Lines serves the states of New York and New Jersey and maintains eight conveniently located terminals. The company employs over 750 people and in 1955 rolled up over 8,300,000 total miles.

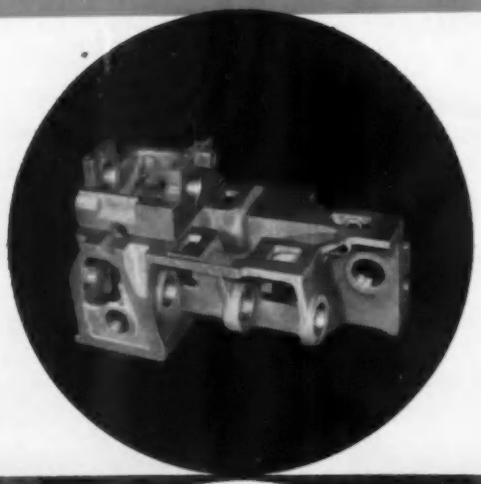
It is a rarity indeed when a product in any field demonstrates customer preference so strong that it continually *outsells all other competition combined* year after year. Yet, for the past twenty-seven years, this has been the remarkable accomplishment of Bendix-Westinghouse Air Brakes in the truck and bus fields! In fact, recognition of the greater safety, economy and dependability of Bendix-Westinghouse Air Brakes by truck buyers has resulted in their factory installation on more and more truck models of all sizes.

Chances are good that your trucks, too, offer the many advantages of these powerful brakes. If not, we suggest you take advantage of the proven superiority of Bendix-Westinghouse Air Brakes by offering them as factory-installed equipment. It's one sure and easy way to add more sales-appeal to your vehicles!

Over 2,000,000 compressors, produced over a twenty-seven-year span, stand behind the TU-FLO 400. Many advanced features guarantee performance no other compressor can equal.

**Bendix-Westinghouse** AIR BRAKES

BENDIX-WESTINGHOUSE AUTOMOTIVE AIR BRAKE COMPANY • General offices and factory—Elyria, Ohio. • Branches—Berkeley, Calif., and Oklahoma City, Okla.



*At Brown & Sharpe*

# Natcos Help From

*At Brown & Sharpe, a 22-spindle Natco 3-way Machine handles finished drilling, boring and reaming on "00" screw machine beds*

NATCO

# Slash In-Process Time 16 Weeks to One Week

## *On Automatic Screw Machine Beds*

Even on precise machine tool parts, traditionally handled on a "job-shop" basis, Brown & Sharpe gained great advantage by installing an automatic line. Prominent in the line are two Natcos, engineered and tooled to handle all drilling, boring and reaming on either the No. 00 or No. 2 automatic screw machine beds.

One Natco does all roughing—the second handles finishing. Total of 62 operations. Each Natco is tooled to process two parts at once—tooling is interchangeable to accommodate either sized bed.

Extreme machine tool accuracy must be maintained throughout. In one operation the Natco drills through five walls, holding centers parallel to the locating surface within .0015" for the full 42" distance. In another case, Natco engineering devised a tooling leaf that automatically drops through a core in the part, providing internal boring bar support.

Natcos make sense even on "job-shop" jobs. Call in a Natco Field Engineer—he can quickly tell you whether a Natco can be a cost-saver on your next job.

## National Automatic Tool Company, Inc.

*Richmond, Indiana* ***Multi-spindle drilling, boring, and tapping machines. Special machines for automatic production.***

***Call Natco Offices in Chicago, Detroit, New York, Buffalo, Boston, Philadelphia, Cleveland, Los Angeles; distributors in other cities.***

*HILL Sheet Grinder and Polisher with reciprocating hydraulic table processing individual sheets.*

# HILL

## GRINDING and POLISHING MACHINES

*How much is it costing you to produce ACCEPTABLE finishes on FLAT surfaces*

*HILL Pinch Roll Grinder and Polisher for "Wet" or "Dry" operations. (Shown in series for straight line production)*

**HILL** 2-Roll Vertical Abrasive Belt Grinding and Polishing machines are the logical result of 25 years of research and experience in producing self contained units for successfully processing ferrous and non-ferrous sheets. We have consistently proven that wide abrasive belt grinding and polishing equipment must incorporate these fundamental features — rugged construction, simplicity of design, accessibility, versatility and centralized controls.

HILL abrasive belt polishing machines are recommended for continuous operation and insure lower production costs with superior finishes as required today by the manufacturers of decorative plastics, food processing equipment, automobile bumpers, lithographers and photo engravers plates, home appliances, etc., etc.

Both types of machines are normally built up to 60" wide, and larger capacity equipment can also be furnished.

Your inquiries are solicited for detailed information and recommendations.

TOOLS FOR INDUSTRY

# THE HILL ACME COMPANY

**ACME MACHINERY DIVISION** • **1209 W. 65th St., Cleveland 2, Ohio**

ESTABLISHED 1882

"ACME" FORGING • THREADING • TAPPING MACHINES • ALSO MANUFACTURERS OF "HILL" GRINDING & POLISHING MACHINES
HYDRAULIC SURFACE GRINDERS • "CANTON" ALLIGATOR SHEARS • BILLET SHEARS • "CLEVELAND" KNIVES • SHEAR BLADES


# "The best parts? Sure, they're made of Stainless"

"As head of the Parts Department, I get a close-up view of this swing to Stainless Steel, and I think it's the smartest move the auto makers could make." This from the manager of the Parts Department of a large midwestern agency.

"They say if replacement parts are made of cheap materials, our business would be better. We haven't found that to be true. Just the opposite in fact. As parts are improved, our business, anyway, has continued to grow. Our customers realize the added value of Stainless Steel."

Stainless trim and accessories keep cars looking better, longer, both inside and out. Stainless parts, like the rear fender plate, shown above, shrug off flying stones, road salt, etc., without marking, discoloring, peeling or corroding.

Much of the Stainless Steel being used by leading automotive concerns comes from the mills of Sharon—where buyers know they can expect consistent quality plus the industry's finest finish.

SHARONSTEEL

**SHARON STEEL CORPORATION**

SHARON, PENNSYLVANIA

DISTRICT SALES OFFICES: Chicago, Cincinnati, Cleveland, Dayton, Detroit, Grand Rapids, Indianapolis, Los Angeles, Milwaukee, New York, Philadelphia, Rochester, San Francisco, Sharon, Seattle, Montreal, Que., Toronto, Ont.

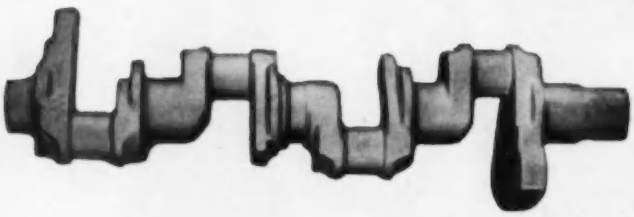
9179

# whether you think in terms of

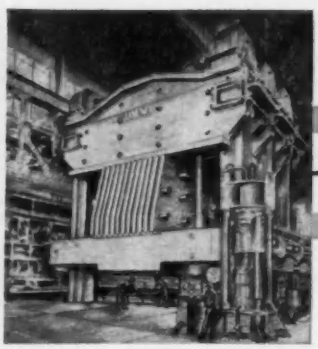
## Horsepower

— or —

## Thrust

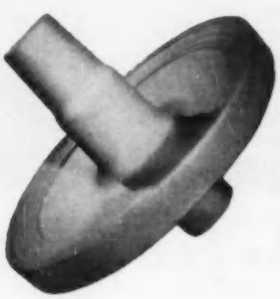


The crankshaft is the backbone of the piston-type engine. Illustrated above is the crankshaft forging for the most powerful piston-type aircraft engine ever produced.



The history of Wyman-Gordon's contribution to aircraft progress dates from the inception of the "flying machine". The jet age is now calling on the unparalleled resources of Wyman-Gordon, which include the widest range of hammer and press equipment and the greatest technical know-how in the industry. Larger and more intricate forgings than heretofore available of aluminum and magnesium are being produced on presses up to 50,000 ton capacity, and giant hammers are fulfilling the growing need for forgings of titanium, high density materials or so-called super alloys. Now, as for nearly 75 years, there is no substitute for Wyman-Gordon experience and ability for — Keeping Ahead of Progress.

At the bottom left is a turbine disc forging made from high density heat resisting alloy, and next to it is a titanium compressor wheel forging for two of the most powerful jet engines yet produced.



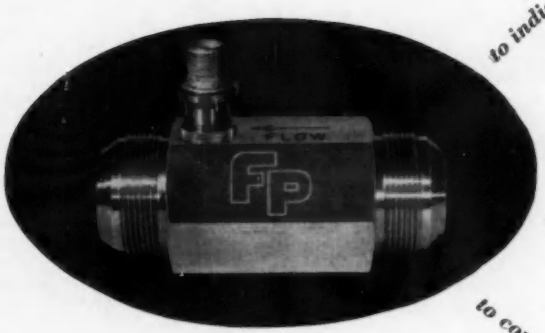
# WYMAN-GORDON COMPANY

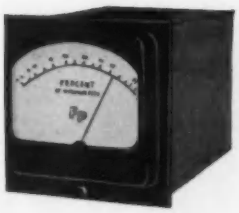
*Established 1883*

FORGINGS OF ALUMINUM • MAGNESIUM • STEEL • TITANIUM

WORCESTER 1, MASSACHUSETTS

HARVEY, ILLINOIS • DETROIT, MICHIGAN





PANEL FLOW RATE INDICATOR

*to indicate flow*

*to indicate steady state flow condition*

IN-LINE DIGITAL INDICATOR

*to totalize flow for batch processes*

DIGITAL TOTALIZER

*to convert transient flow for analog output*

FREQUENCY MULTIPLIER-CONVERTER

## get flow information in any form you need it

**. . . with F&P turbine meters and readout devices**

Here's the ideal solution to flow metering problems characterized by high temperature, high pressure, high flow volume, or rapid flow transients. Fischer & Porter turbine meters are inherently among the most accurate flow measuring devices available today . . . providing measurements accurate to ½% of instantaneous rates.

The low inertia, axially balanced rotor of the F&P turbine meter gives optimum response to rapidly changing flow rates . . . providing positive information on changes as soon as they *begin*, not after they happen. A basic frequency output, directly proportional to flow, provides a common language easily fed to indicating, recording, or transmitting equipment. You can have digital or analog indication . . . oscilloscope recording . . . circular or strip chart recording . . . digital totalizing . . . transmission or any combination of these. Here are just a few of the Fischer & Porter output devices you can dovetail with one or more turbine meters:

PANEL FLOW RATE INDICATOR: Provides scale reading in desired flow units or in percentage of maximum flow. Includes amplifier which may be used to feed EPUT meters or integrators, and analog converter.

"IN-LINE" DIGITAL INDICATOR: Direct digital readout of flow information in desired gravimetric or volumetric units. Automatically selects turbine meter outputs by flow range.

DIGITAL TOTALIZER: Provides integrated flow information accurate to ½%.

FREQUENCY MULTIPLIER-CONVERTER: Extremely rapid response to transient flow signals. Sampling of eight points per cycle provides more information than conventional means.

For complete data on the F&P turbine meter and some of the systems it makes possible, write for catalog. Address request to Fischer & Porter Co., 4757 County Line Road, Hatboro, Penna.

**FISCHER & PORTER CO.**

*Complete Process Instrumentation*

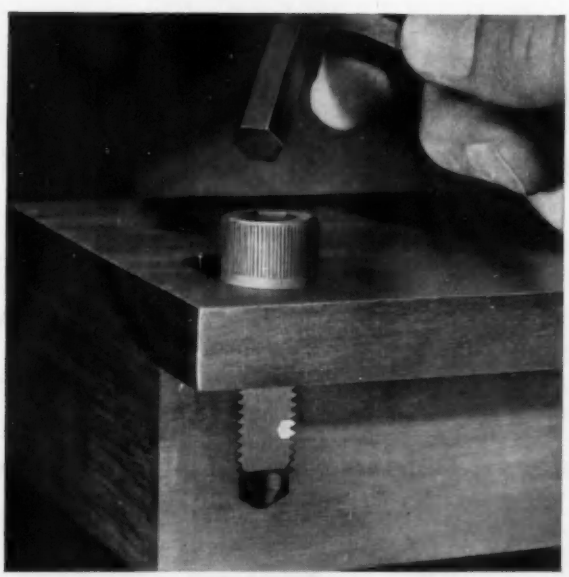
# CALENDAR

## OF COMING SHOWS AND MEETINGS

Engineered Castings Show, Cincinnati, O. ..... May 6-10
Industrial Tool and Production Show, Toronto, Canada .... May 6-10
British Industries Fair, Birmingham, England ..... May 6-17
AIEE Aircraft Meeting, Biltmore Hotel, Dayton, O. ..... May 7-9
American Helicopter Society, annual forum, Sheraton-Park Hotel, Washington, D. C.... May 8-11
Fluid Control Institute, spring meeting, Greenbrier, White Sulphur Springs, W. Va..... May 8-11
Tokyo Motor Show, Japan .... May 10-19
Industrial Waste Conference, Purdue Univ., Lafayette, Ind.. May 13-15
American Petroleum Institute, Div. of Refining, mid-year meeting, Sheraton Hotel, Philadelphia, Pa. ..... May 13-16
Industrial Nuclear Technology Conference, Museum of Science and Industry, Chicago, Ill. .... May 14-16
Engineering Industries Exposition, Hotel Statler, New York, N. Y. May 16-18
Hoist Manufacturers Association, meeting, Mayflower Hotel, Washington, D. C. ..... May 16
American Institute of Industrial Engineers, annual conference and convention, Hotel Statler, New York, N. Y. ..... May 16-17
National Industrial Conference Board, annual meeting, Waldorf-Astoria, New York, N. Y. May 16-17
ASME Oil and Gas Power Conference, Kentucky Hotel, Louisville, Ky. ..... May 19-23
Design Engineering Conference and Show, Coliseum, New York, N. Y. ..... May 20-22
American Petroleum Institute, Div. of Marketing, mid-year meeting, Chalfonte-Haddon Hall Hotel, Atlantic City, N. J..... May 20-22
Fabricating Machinery Hydraulic Conference, sponsored by Vickers, Inc., Sheraton Cadillac Hotel, Detroit, Mich. ..... May 21-22
American Society for Quality Control, convention and exposition, Masonic Temple, Detroit, Mich. May 22-24
National Automotive Service Show, Boston, Mass. ..... May 23-26
Paris Air Show, France... May 24-June 2
Paris International Trade Fair May 25-June 10
Indianapolis Race, Ind. ..... May 30
American Gear Manufacturers Association, annual meeting, The Homestead, Hot Springs, Va. June 2-5
SAE Summer Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J. ..... June 2-7
American Society of Civil Engineers, national spring convention, Buffalo, N. Y. ..... June 3-7
Technical Personnel Recruiting Exposition, Hotel Sherman, Chicago, Ill. ..... June 8-12
ASME Semi-Annual Meeting, Sheraton-Palace Hotel, San Francisco, Calif. ..... June 9-13
Western Plant Maintenance & Engineering Conference and Show, Civic Auditorium, San Francisco, Calif. ..... June 11-13
International Congress of Combustion Engines, general meeting, Zurich, Switzerland ..... June 15-25
American Society for Testing Materials, annual meeting, Atlantic City, N. J. ..... June 16-21

**The ordinary fasteners** securing the worm wheel to the drum shaft in this automatic screw machine loosened, causing $120 worth of damage to parts. Labor for the repair job cost $100. The ordinary fasteners were replaced with self-locking UNBRAKOS, and there has been no trouble since.

# Vibration won't loosen self-locking UNBRAKO socket cap screws



**HOW IT LOCKS.** The tough, resilient Nylok locking pellet keys itself into the mating threads. It forces threads together and locks the screw securely—whether or not the screw is seated.

UNBRAKO socket screws with the Nylok* self-locking device eliminate fastener problems caused by vibration.

Take the drive system in the automatic screw machine illustrated above, for example. The screws originally used to secure the worm wheel to the drum shaft loosened, causing considerable damage, besides loss of production time. These have now been replaced with self-locking UNBRAKO socket head cap screws and the trouble has been eliminated.

An UNBRAKO socket screw with the Nylok self-locking device is a single unit. Just screw it into any tapped hole. Seated or not, it locks positively wherever wrenching stops. Constant vibration or endless running of a machine won't affect these self-locking UNBRAKOS. The screws will not work loose!

Write today for your copy of Form 2193, which gives catalog and technical data on the complete line of UNBRAKO socket screws with the Nylok self-locking device. Or see your local industrial distributor. Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 53, Pa.

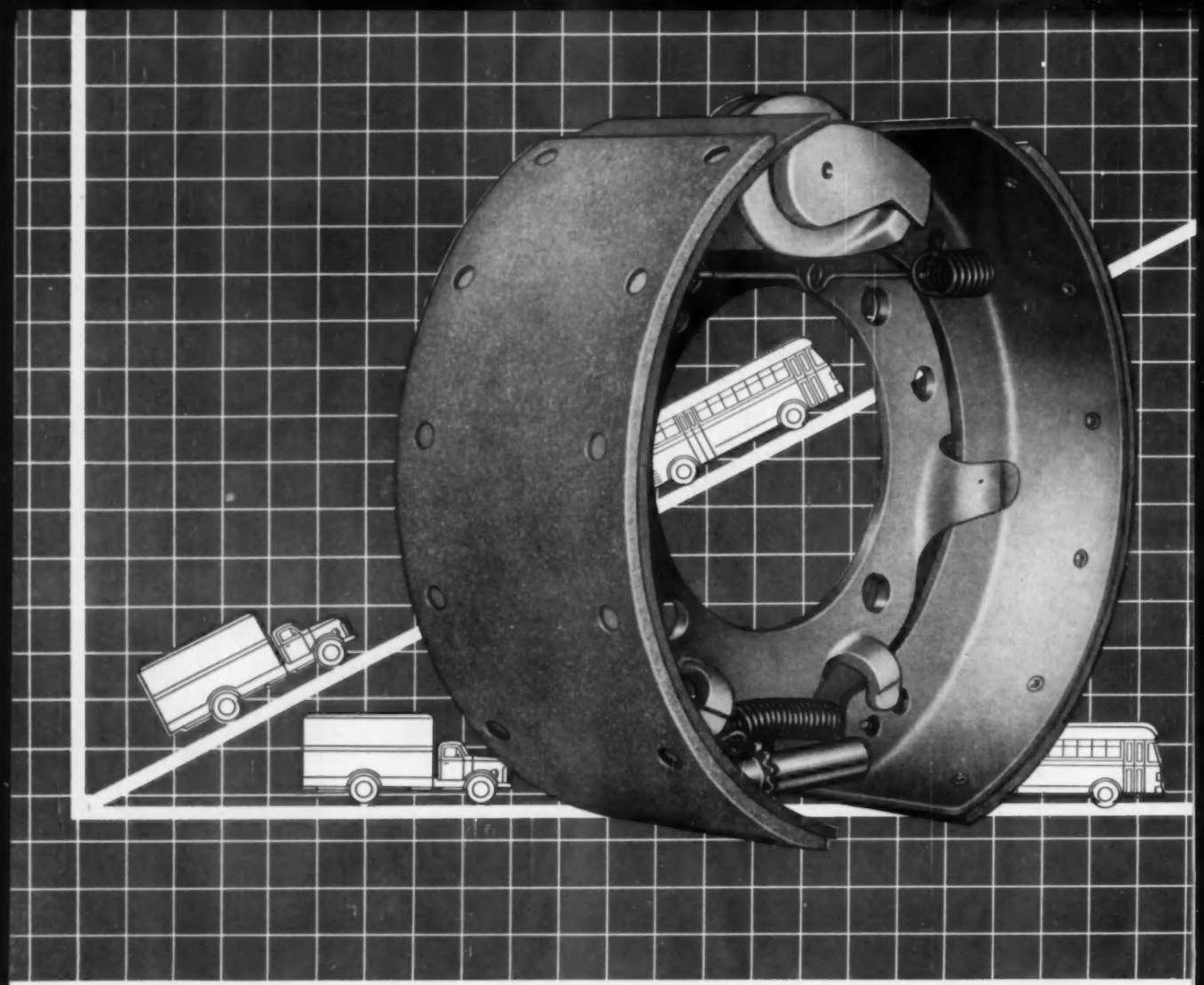
UNBRAKO SOCKET SCREW DIVISION

STANDARD PRESSED STEEL CO.

SPS

JENKINTOWN PENNSYLVANIA

*T.M. Reg. U.S. Pat. Off., The Nylok Corporation



# BENDIX DUO-DUTY AUXILIARY BRAKE

## Power to hold on grades . . . Power to stop at road speeds

The Bendix* Duo-Duty auxiliary brake serves the double purpose of a positive parking brake and an emergency road-speed brake.

**FOR PARKING,** the Duo-Duty brake has ample torque capacity to keep the braked wheels from rolling on any hill or ramp, regardless of how steep.

**FOR EMERGENCIES,** it has the torque and thermal capacity to serve as a dependable stand-by brake at road speeds should the main braking system, for any reason, fail to work.

Minimum physical pull at the hand lever, less weight, fewer parts, mechanically simple.

A heavy-duty drive shaft brake that is rugged and right . . . built and backed by Bendix.

*REG. U.S. PAT. OFF.

**BRAKES • POWER STEERING • POWER BRAKING • CONSTANT VELOCITY UNIVERSAL JOINTS • HYDRAULIC REMOTE CONTROLS**

**Bendix PRODUCTS DIVISION South Bend, IND.**

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# High Spots of This Issue

## ★ Flexible Equipment for Making Variety of Engines

Back in the early part of 1956, Hercules Motors Corp. developed a line of heavy-duty engines that is now available in three different model series. Unfolded here is the story of how manufacturing was planned for cost economy. Page 48.

## ★ Geneva—Europe's 1957 Spring Show

Switzerland became the center of automotive show activity with the advent of Spring. Assembled in Geneva were the latest U. S., as well as European products. Highlighted in this report are the leading developments of interest. Page 56.

## ★ Advanced Tooling for the British Ferguson Tractor

Standard Motor Co. of England has retooled and modernized its tractor plants so that it is now the largest tractor manufacturer in Europe. How this was accomplished quickly to produce the new Ferguson 35 model is related here. Page 60.

## ★ Copper, Brass and Bronze in Automotive Vehicles

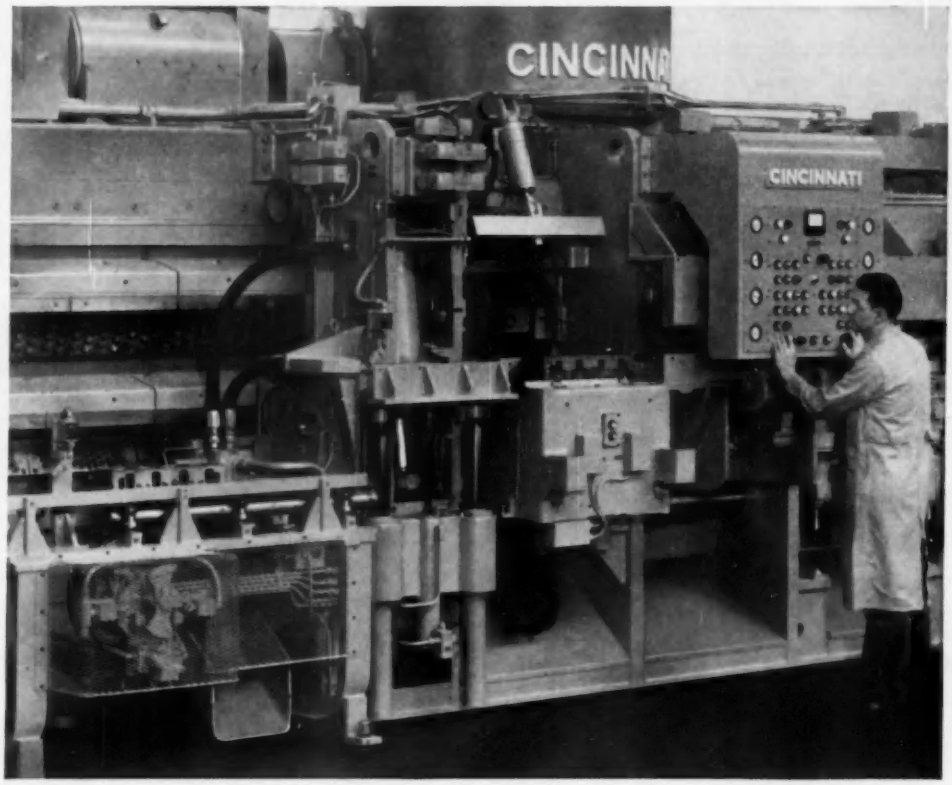
The red metal and its alloys—brass and bronze—are gobbled up at a furious rate by the automotive industries, some 200,000 tons last year. Surveyed in this article are its various current uses and its many potential applications. See Page 68.

## ★ Communist-Built Vehicles Shown at Leipzig Fair

What's going on automotive-wise behind the mysterious Iron Curtain? A number of answers to the question were provided in the exhibits at the recent Leipzig Fair in East Germany. Presented in this account are the major things seen. Page 70.

## ★ 37 New Product Items And Other High Spots, Such As:

Vertol commercial helicopter; industry statistics; liquid-cooled automotive brakes; SAE Aeronautic Meeting; higher highway speeds; spraying speedometer dials; automatic lubricant spray system; and AWS meeting.




Cylinder heads are broached on this new CINCINNATI® Horizontal Hydro-Broach Machine, completely tooled up and ready for installation in a modern, fast-moving production line. Operation—Finish broach top face, intake and exhaust manifold faces; rough broach joint face. Production—160 per hour.

# Machining Costs Reduced Again

## . . . for Cylinder Heads Broached on New CINCINNATI Horizontal Hydro-Broach Machine

CINCINNATI Horizontal Cylinder Head Broaching Machine. Other machines of this type are illustrated in catalog No. M-1910.

There's only one way for the cost of machining to go. DOWN. And for cylinder heads broached on the new CINCINNATI illustrated above, costs go down to a lower level than ever before. This fine new Horizontal Hydro-Broach Machine is completely automatic, with single cycle push-button control for start-up after resetting the broach inserts, etc. ¶ Other advantages include elevator for work transfer after second operation; complete power handling of the work; mechanical drive to the ram with speeds up to 200 feet per minute; inserted sintered carbide tools; automatic circulating lubrication; arranged for integration with other machines into automatic production line.

**The machine operates at a production rate of 160 cylinder heads per hour.**

This outstanding advancement in cylinder head broaching machines may have the effect of making your present equipment economically obsolete. Our Broaching Specialists will help you decide if replacement is in order. May we hear from you?

***Special Machine Tool Division***

**THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO**

# CINCINNATI

CINCINNATI

**MILLING MACHINES • BROACHING MACHINES • CUTTER AND TOOL GRINDERS • METAL FORMING MACHINES HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID • GRINDING WHEELS**

# News of the AUTOMOTIVE AND AVIATION INDUSTRIES

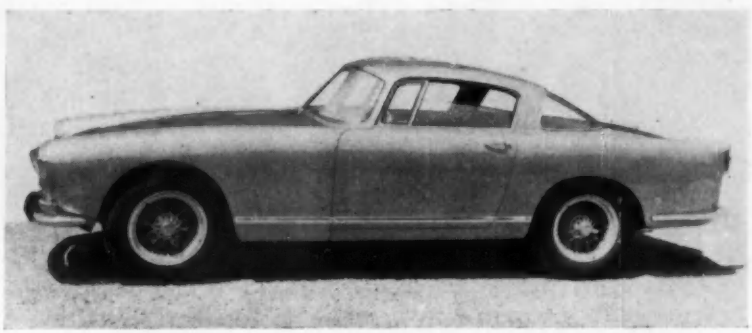
**Vol. 116, No. 9** **May 1, 1957**


### *Ford Quarterly Net, Sales Soar Up Over 1956 Figures*

Ford Motor Co. has reported that its net income in the first three months rose more than 36 per cent from the first quarter last year on a sales increase of 30.5 per cent.

Net income of $100.5 million compared with $73.7 million in the first quarter of 1956. Net sales of $1,569,500,000 were the highest quarterly sales in the history of the company. They compared with sales of $1,203,100,000 in the first quarter of 1956.

Factory sales of cars and trucks in the first quarter were 626,206 units. The figure compared with 523,392 units in the first quarter of 1956.



**FERRARI TOURING CAR HAS V-12 POWER PLANT**

*The Ferrari 250 touring car is powered by a V-12 gasoline engine with a displacement of approximately 185 cu in., compression ratio of 8.5 to 1, and a maximum output of 240 bhp at 7000 rpm. Gearbox has a total of four synchronized forward speeds.*

### *Additional Makers Plan Hardtop Station Wagons*

At least two more automobile companies are planning to introduce station wagons with hardtop styling in 1958. Buick, Oldsmobile and Rambler are only makes which currently offer "wagons" without the center pillar. Popularity of such models is indicated in a report from Buick, which notes that 70 per cent of its station wagon orders specify hardtop models.

### *New Concessions Granted To Dealers By Chrysler*

Chrysler Corp. last month followed on the heels of Ford in revamping its dealer program. The three-point program includes a new sales agreement, a new parts and accessories plan, and a dealer group life insurance program.

Effective July 1, the new program provides increased assistance to a dealer in disposing of his property and equipment in the event of franchise termination and enables a deceased dealer's widow to hold a financial interest in the business without time limitation, and expands the dealer's right to nominate his successor. The new contract also spells out causes for which the company may terminate the agreement. It is a continuing agreement without a fixed terminating or reviewing date, and the dealer may cancel it on 30 days' notice.

Under the new parts and accessories program, a dealer may return parts for credit within 90 days of purchase and accessories within 30 days. The two per cent cash discount for parts is retained. The new insurance plan provides insurance for qualified dealers in amounts ranging up to $100,000.

### *Dodge Planning to Offer New Truck Utility Body*

Offered by Dodge soon will be a new utility body for ½ and ¾-ton trucks. It's designed basically for electricians, plumbers, painters and other tradesmen. The 7½ ft body has exterior side compartments and sliding roof.

### *Cross Opens Its New Plant For Automation Machinery*

The new $6 million factory and office building of The Cross Co. was formally opened last month. Said to be the first all-new facility in the U. S. built solely for the production of automation machinery, it is located on a 67-acre plot at 17801 East Fourteen Mile Rd., Fraser, Mich., on the outskirts of Detroit.

Milton O. Cross, Jr., president, pointed out at the opening that the occasion marked the completion of the first phase of an expansion program that enables the company to step up its present $15 million sales volume to $25 million eventually. Mr. Cross also noted that advanced concepts in organizing and programming work have been integrated with the last manufacturing techniques in the new facility.

Among the many plant features are: simulated line production; a data processing department with a Univac high-speed electronic computer; and a novel engineering set-up that provides intra-company competition for engineering ideas.

# NEWS AUTOMOTIVE AND AVIATION

**AUTOMATIC ELECTRIC MOTOR PRODUCTION**

*The most modern materials handling methods were applied by Reliance Electric and Engineering Co. in designing its recently opened Plant No. 3 at Ashtabula, O. The highly automated plant which builds electric motors from 1 to 40 hp, was planned around the philosophy of building parts for stock, rather than specific order. Parts are then assembled to meet customer needs. Illustration depicts the finishing department with roller and overhead conveyor system.*

### Buick Puts Brakes To Test In Rugged Los Angeles Area

Buick has set up a "proving ground" right within the city of Los Angeles for testing brakes. It consists of a 196-mile route covering all the major freeways, mountain roads, and downtown traffic.

The extreme variance of road conditions in that area provides Buick engineers with important data on brake wear not possible in ordinary proving ground tests. Three drivers cover the route daily to determine wear on brakes. Each car carries special equipment to record brake pedal pressure, brake temperature, and other data.

### National Automobile Show Date for '58 Not Yet Set

A decision by the Chicago Automobile Trade Association to hold its 1958 show during the period of Jan. 4 to 12, 1958, has upset plans of the Automobile Manufacturers Association for its next national show in New York City. AMA was hoping to hold an early January show, but it may now change to some other time to avoid conflict with the Chicago show.

At any rate, the whole matter is up in the air at the moment. Definite dates are expected to be set by AMA soon, however. The Chicago Trade Association said it was unable to change its dates because of other commitments by the International Amphitheater.

### Fiat of Italy Launches Drive In U. S. Market With Two Cars

Fiat of Italy is entering the U. S. automobile market with two models initially in several versions. One is the Fiat 600, seating four, wheelbase 6 ft, 6¾ in. The other is the Fiat 1100, seating four, somewhat roomier than the 600, with a wheelbase of 7 feet, 8 in.

Price of the 600 will be $1295 delivered in New York, compared with $1024 in Italy. The price of the 1100 model will be $1655 delivered in New York.

Fiat has designated Hoffman Motors of New York City as its distributor. Initial sales efforts will be concentrated along the Eastern Seaboard, and in California.

### Lincoln Starts Operations In New Home In Novi-Wixom

Lincoln Div. last month started operations in its new headquarters in the Novi-Wixom area. The sector lies 28 miles northwest of downtown Detroit.

The new facilities include a 200,000 sq ft, three-story office building, a 1.3 million sq ft assembly plant, test track, and power plant. They give Lincoln, for the first time in history, completely separate facilities for the administration, production, and distribution of its cars. Nearly 5000 persons will be employed at peak periods, with an annual payroll of approximately $30 million.

Full operation will be reached with the start of production of 1958 models in late summer. Capacity of the new plant (on straight-time) is approximately 112,000 cars a year.

The new Lincoln facilities are second only in size to Ford's Mahwah, N. J., and Dearborn Rouge plants in the company's system of 21 assembly plants.

### Chrysler First-Quarter Sales Exceeded $1.1 Billion Figure

Chrysler Corp. chalked up sales totaling more than $1.1 billion during the first quarter, L. L. Colbert, president, told a shareholders' meeting last month. Earnings for the quarter will not be known until the middle of this month, when the financial report is due.

The corporation's share of the automobile market in the first quarter has been at the highest level the company has enjoyed in more than three years. It climbed to slightly better than 20 per cent and compared with 14.5 per cent a year ago.

During the first quarter, the company shipped 421,000 vehicles, about one-third more than during the January-March period last year. The corporation is highly optimistic about prospects for the second quarter, despite recent output curtailments which have followed a UAW ban on all overtime at Chrysler plants.

The "stop-overtime" edict was issued by the union in an attempt to settle a labor dispute at Chrysler's Los Angeles assembly plant, which has been idle for several weeks. Chief dispute at that plant is over the rate of output.

Twenty directors were re-elected at the shareholders' meeting in Detroit. One new board member was named. He is Paul C. Ackerman, director of engineering.

### AMC Repeats Faith in Future; Wolfson Lends Romney Support

George Romney, president of American Motors Corp., and financier Louis E. Wolfson, the company's major stockholder, met with Detroit newsmen last month for a conference on the future course of the company. Mr. Wolfson said that he had conferred with Romney, had looked over prototypes of 1958 AMC cars and appliances, and was satisfied with what he saw. He also stated that Romney had given assurances that operations would be in the black early in 1958 and that he was inclined to go along with the management all the way with that understanding.

The company is also working on several proposals, including suggestions made by Wolfson and others. This is taken to mean that AMC is exploring the possibilities of mergers, or acquisitions, some of which are expected to materialize before the end of this year.

In answer to many questions, Mr. Romney said definitely that the so-called "senior" lines (Nash and Hudson) will be represented in the new offerings for 1958 and that there is no truth in rumors that these models will be discontinued. Moreover, since the passenger car business represents about 50 per cent of the company's volume, there is no thought of abandoning it.

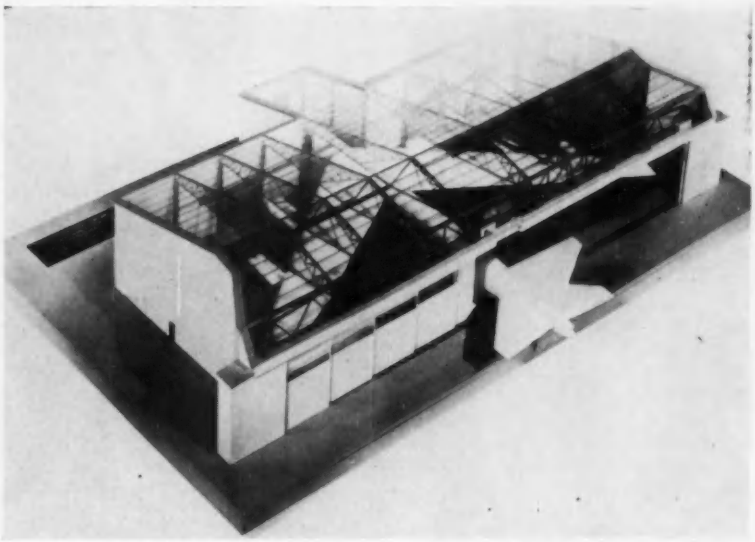
AMC's dealer representation is said to be good. Since April, 1956, the company has added 545 dealers, and of these new dealers only 15 have dropped out.

### White Predicts 30% Of Sales Will Come From Diesel Units

Growth of the Diesel engine market is pointed up by J. N. Bauman, president of White Motor. He predicts Diesel-powered models will account for 30 per cent of the company's total truck sales this year. That compares with only 8 per cent in 1954. White, which now buys all its Diesel engines, hopes to develop its own under a long-range research program.

### Air Cooler For Trucks Being Readied By Dodge

Dodge soon may make available an air-conditioning unit for trucks. It would be similar to the portable unit now offered as a dealer-installed accessory on Chrysler Corp. cars, except it would be smaller and more compact for installation in truck cabs.



**AIRCRAFT MAINTENANCE SPEEDED BY NEW DOCK**

*Shown here is a cut-away model of new maintenance dock designed for the Air Force by Luria Engineering Co. The readily erected steel structure is specially intended for fast and efficient maintenance of the B-52 and other military aircraft. Fitted with tailored, movable platforms for several types of planes, the dock also provides shelter for maintenance crews in all kinds of climates.*

### S-P to Sell "Economy" Line and Mercedes-Benz Cars

Studebaker-Packard Corp. has confirmed reports that it will bring out a new line of "economy" cars selling in the neighborhood of $1800 and that its dealers soon would start marketing the German-made Mercedes-Benz cars, which carry price tags up to $13,000. The lower-priced cars, according to one report, will be "dechromed" versions of the company's present Champion series, which now carry price tags of $1890 and up.

Three models will be offered in the new line—a two-door sedan, a four-door sedan, and a station wagon. The two-door model will carry an advertised delivered price of $1795, with the other two priced above that. Heater, defroster and directional signals will be standard equipment on the two-door model.

The cars will carry the present Champion six-cylinder engine, which the company claims will be able to achieve fuel economy of 25 to 29 miles a gallon. An eight-cylinder engine will probably be offered also. Reports that Daimler-Benz would supply S-P with a six-cylinder passenger car engine are unconfirmed.

The Mercedes-Benz line of cars will be sold exclusively by S-P's 2400 dealers in the U. S. and Canada starting in May under an agreement with Daimler-Benz. Until now, the car has been marketed in the U. S. by Hoffman Motors, Inc., New York foreign car dealer-distributor, whose franchise terminates May 20. Eventually, S-P dealers also are expected to take on the Daimler-Benz truck line, including Diesel-powered units and four-wheel-drive utility vehicles. Under the agreement, S-P also will have exclusive rights to many other Daimler-Benz features,, such as swing axles, transmissions, fuel injection, and other products and components.

It was also disclosed that Daimler-Benz and Curtiss-Wright have set up a U. S. Company — Curtiss-Wright and Mercedes-Benz, Inc.—to provide for the development and sales of Daimler-Benz products in the U. S., Canada, Mexico and Cuba. Likewise, Utica-Bend Div. of Curtiss-Wright will import, manufacture, and sell Mercedes-Benz Diesel engines—ranging from 25 hp to 600 hp—as well as Diesel and gasoline fuel injection systems.

There is considerable likelihood that such Mercedes-Benz developments as fuel injection will eventually be offered on the Studebaker-Packard lines of passenger cars, although probably not on the 1958 models to be introduced next fall. In this connection, it was emphasized that the Packard line of cars will not be discontinued, notwithstanding all the

rumors that have been rampant; on the contrary, a new model will be added to the Packard line somewhat akin to the Studebaker Hawk sports car.

On the financial side, S-P is confident it will be in the black this year. Roy T. Hurley, president of Curtiss-Wright, which counsels S-P operations under a management agreement, indicated S-P would show a "modest profit" in 1957. Last year the company had a deficit of $43.3 million, although it showed an operating profit of $895,000 in the last two months of the year.

### Allison Transmission Weighed By Dodge Div. for Truck Use

A new six-speed automatic transmission made by GM's Allison Div. is being considered by Dodge for one-ton-and-over trucks. Ford started offering the automatic this month on its medium units under the name "Transmatic," and will make it available on heavy units in June. First brought out by Chevrolet last year as the "Powermatic," the unit also is being considered by other truck builders.

### Quadri-Headlamps To Appear On Some Light Trucks In '58

New improvements are coming in truck lighting. In addition to headlamps, taillights are getting a lot of attention from truck builders.

Four headlamps, now found on cars, will start appearing on some light trucks in 1958. They are expected to become universal on trucks by 1960.

### Chrysler Corp. Entries Capture All Top Places in Economy Run

Chrysler Corp. cars rode off with all top honors in the 1957 edition of the annual Mobilgas Economy Run. The contest was run during the period of April 14 through 18 over a tortuous 1568-mile course from Los Angeles to Sun Valley, Idaho.

Sweepstakes winner and also top scorer in the upper-price class was an Imperial Crown sedan with 64.5153 ton miles per gallon and 20.9465 miles per gallon. First-place in the upper-medium class was taken by a Chrysler Saratoga with 56.7267 tmpg and 20.7032 mpg.

#### ECONOMY RUN RESULTS

| | Miles Per Gallon: | Ton Miles Per Gallon: |
|---|---|---|
| **Low-Price Class** | | |
| Plymouth Belvedere V-8 | 21.3907 | 52.6211 |
| Ford Fairlane 500 Six. | 22.2534 | 52.5181 |
| Chevrolet Bel Air V-8. | 21.2636 | 49.4378 |
| Chevrolet Bel Air Six. | 21.4948 | 49.0080 |
| Rambler Rebel "8" | 21.6214 | 47.8914 |
| Ford Fairlane 500 V-8. | 19.1567 | 45.4013 |
| Ford Fairlane 500 Six. | 22.1201 | 52.3140 |
| Ford Fairlane 500 V-8. | 18.9456 | 44.9959 |
| Plymouth Belvedere V-8 | 20.8968 | 51.4061 |
| Chevrolet Bel Air V-8. | 20.7236 | 47.5606 |
| **Low-Medium Price Class** | | |
| Dodge Coronet 500 V-8 | 22.0047 | 55.8920 |
| Oldsmobile 88 Holiday. | 19.5149 | 52.7877 |
| Pontiac Chieftain | 20.4221 | 50.2384 |
| Studebaker President V-8 | 19.9453 | 44.8769 |
| Dodge Coronet 500 V-8 | 21.7803 | 54.4509 |
| **Upper-Medium Price Class** | | |
| Chrysler Saratoga | 20.7032 | 56.7267 |
| DeSoto Firedome | 20.9838 | 56.4464 |
| Oldsmobile 98 Holiday. | 19.2164 | 53.5177 |
| DeSoto Firedome | 18.4994 | 48.0985 |
| Oldsmobile 98 Holiday. | 18.7247 | 52.1482 |
| **High-Price Class** | | |
| Imperial Crown | 20.9465 | 64.5153 |
| Buick Roadmaster | 18.6287 | 52.3466 |
| Imperial Crown | 19.9527 | 61.7535 |

Low-medium class honors went to a Dodge Coronet 500 with 55.8920 tmpg and 22.0047 mpg. Topping off the triumph for Chrysler Corp. was the emergence of a Plymouth Belvedere as winner in the low-price class with 52.6211 tmpg and 21.3907 mpg.

Average ton miles per gallon for all cars was 52.0414, and average miles per gallon was 20.4865. Average speed for all cars was 41.2524 mph.

### Piston Engine for Automobiles Expected to Stay for Some Time

Chevrolet general manager E. N. Cole met the Detroit press recently for a seminar on some of the engineering developments in the air today. As far as power plants are concerned, Mr. Cole believes that the reciprocating engine is here to stay for a long time to come, certainly for the next 10 years. He foresees further developments both in design and manufacturing methods that should make the piston engine still more attractive.

He feels, too, that we have a long way to go to satisfy the need for adequate acceleration in terms of horsepower delivered at the wheels. This implies that the end of displacement engines and further increases in output are still off in the future. In fact, Mr. Cole believes the only limitation is in the displacement of the engine from a practical engineering standpoint.

Gas turbines are of interest, of course, but he believes they are more practical for heavy-duty truck operations than for automobiles, at least in the present state of development.

Touching on Chevrolet's business, Mr. Cole stated that Corvette production for 1957 has been upped to 30 a day, compared with 25 last year. He also said they have an impressive backlog of orders for Corvettes.

Station wagons are becoming big business for Chevrolet. In fact, it was estimated that within not more than five years station wagons would account for 20 to 25 per cent of registrations.

There was considerable discussion of the invasion of small, economical foreign cars. The question now is whether there is sufficient real public demand for small, cheap cars to warrant their widespread introduction by our own industry. Would demand support a yearly production of a minimum of 500,000 units?

Moreover, what are the psychological implications of the wave of foreign car buying? Is it strictly economy, or is it evidence that several hundred thousand people out of our population want a "different" foreign car? Many of these intangibles would have to be evaluated before any decision can be made.

One thing is sure: for the first time in some years industry leaders apparently are thinking in terms of meeting the demand for low cost transportation, perhaps as a second or third car.

### GM Contributes $35,000 To Negro College Fund

A $35,000 gift to the United Negro College Fund was announced by General Motors Corp. It brings to $135,000 the amount GM thus far has given to the fund.

The grant was made under GM's expanded program of support for higher education and provides yearly grants to associations of colleges. When in full operation, the plan also will be aiding 1600 outstanding young men and women each year studying under four-year GM scholarships.

**DUAL-PURPOSE PLANE**

*Experimental tilt-wing VTOL research aircraft, developed by Vertol Aircraft Corp., was unveiled recently. Designated the Vertol 76, it is powered by a Lycoming T-53 gas turbine engine placed aft of the cockpit and atop a tubular fuselage structure. Two rotor-propellers are mounted on the leading edge of the wings.*

### Airborne Accessory Power Systems Integrated by GE

General Electric Co. has taken a major step toward integration of its airborne accessory power systems business. It has combined its line of air turbine drive products with its line of hydraulic constant speed drives.

As a result of the combination, the manufacturing of hydraulic drives will be transferred from Schenectady, N. Y., to Lynn, Mass. Approximately 600 employees in the Hydraulic Products Section will be affected by the reorganization.

The Aircraft Accessory Turbine Dept. has also established a systems engineering group at Lynn to interpret the accessory power needs of the aviation industry in terms of optimum systems for specific applications.

### White Motor Sets Records In Both Sales and Income

New high records in both net income and sales in 1956 for the second consecutive year were announced by White Motor Co. Net income amounted to $7,187,875, a gain of 18.6 per cent over the $6,061,180 in 1955.

For the first time in industry, the company's sales crossed the $200 million mark in reaching a total of $207,411,732. This represented an increase of 15.3 per cent over the previous year's total of $179,944,264.

# AI TABLOID

**Pesco Products Div. of Borg-Warner Corp. has become an exclusive aircraft accessory producer.**

* * *

**Kaiser Steel Corp. has made arrangements to finance an additional $81 million expansion program. This will increase the company's current expansion to $194 million.**

* * *

**Westinghouse Electric Corp. forecasts sales approaching a record $2 billion for 1957.**

* * *

**Vickers, Inc., has opened a new plant for its Aero Hydraulics Div. at 3201 Lomita Blvd., at Torrance, Calif. . . . Thompson Products, Inc., is opening a new plant in Manchester, Mo., soon to produce Spirolox retaining rings.**

* * *

**Sun Oil Co. has extended its oil drilling activities to Venezuela.**

* * *

**Brown Trailers, Inc., has announced development of a new air-ride running gear that is coupled with a new aluminum trailer.**

* * *

**Yale & Towne Mfg. Co. is building a new $4 million materials handling equipment manufacturing plant and mid-continent parts depot at Forrest City, Ark.**

* * *

**Purolator Products, Inc., has merged its Detroit area sales offices with those of its wholly owned subsidiary, Industrial Wire Cloth Products Corp.**

* * *

**White Motor Co. and Air-Maze Corp. have developed a new air intake system for gasoline truck engines.**

* * *

**Canadian Car & Foundry Co., Ltd., has changed its name to Canadian Car Co., Ltd.**

* * *

**Westinghouse Electric Corp. is building a new manufacturing and repair plant at Compton, Calif. . . . Air Reduction Sales Co. will build a new air liquefaction plant at Acton, Mass.**

**Firestone Tire & Rubber Co. has added a new 35-hp model to its outboard motor line.**

* * *

**Rotor-Craft Corp. has developed a one-man, rocket-powered helicopter called the "Pinwheel" for the Navy. Civilian model may be offered for less than $1000.**

* * *

**ACF Industries, Inc., has moved its headquarters offices to 750 Third Ave., New York, N. Y.**

* * *

**B. F. Goodrich Co. plans to spend about $41 million on expansion this year. . . . Lukens Steel Co. is launching a $33 million expansion program to boost its rated ingot capacity by nearly 25 per cent.**

* * *

**Lockheed Aircraft Corp. is expected to announce within the next three or four months a new-type airplane to be manufactured at its Georgia Div. plant.**

* * *

**Kaiser Aluminum & Chemical Corp. will build a $2 million aluminum foil processing plant at Belpre, O.**

* * *

**Minnesota Rubber and Gasket Co. has acquired the assets of General Industrial Products Co., Inc. . . . Consolidated Diesel Electric Corp. has purchased the business and assets of Lima Electric Motor Co.**

* * *

**Curtiss-Wright Corp. states that it has no present plans to exercise its option to buy five million shares of Studebaker-Packard Corp. stock.**

* * *

**Westinghouse Electric Corp. has formed new General Products and Apparatus and Defense Advertising Departments.**

* * *

**L. A. Young Spring & Wire Corp. will manufacture and sell the patented Neg'ator constant-force spring in high-volume automotive applications.**

*(Turn to page 125, please)*

# NEWS AUTOMOTIVE AND AVIATION

*Wide range of models are included in the new International 50th Anniversary A-line of motor trucks. Grouping above shows representative models of (left to right): light-duty A-100, A-110, A-120 and A-130; medium-duty A-160; and heavy-duty A-180 series. Gross vehicle weights range from 4200 to 33,000 lb, and power plants are five gasoline and four LPG International Black Diamond valve-in-head, six-cylinder truck engines ranging from 112 to 154 hp, according to the company.*

### Chrysler Corp. Notes Boom In Power Equipment Sales

Demand for power equipment on cars continues to climb. Evidence of this is a report from Chrysler Corp. which shows a notable percentage increase in sales of all items.

The percentage of Plymouth and Dodge car equipped with power steering, for example, currently is twice as great as during the 1956 model run. More than 75 per cent of the Plymouths are being equipped with automatic transmissions, compared with 61 per cent last year.

### IHC Celebrates Its 50th Year; Several Developments Underway

International Harvester Co. celebrated its 50th anniversary in the truck business last month with a closed-circuit television program reaching meetings throughout the U. S. The company also marked the occasion with the introduction of its new A-line of trucks (see illustration).

According to P. V. Moulder, IHC president, the company had a truck sales volume of $573 million in 1956. The figure represented 46 per cent of total sales volume for all divisions to make the Motor Truck Div. the company's largest operating unit.

From an engineering standpoint, IHC is aiming at the development of numerous advanced things of general interest. According to W. D. Reese, manager of engineering, the company is studying the adoption of fuel injection, as well as turbocharging, in seeking avenues of increased power and better fuel economy. He believes that in another year fuel injection systems will be available for truck engines.

IHC is also investigating the feasibility of gas turbines, as well as gasifier-turbine power plants. Mr. Reese does not believe, however, that the gas turbine power plant will appear on a widespread basis in motor trucks for five years or more. He also mentioned that IHC is investigating all manner of new brake systems, including hydraulic retarders.

The company is also in the process of greatly expanding its manufacturing facilities. It has purchased about 530 acres near the present Springfield (Ohio) Works for contemplated expansion. Construction of a major assembly plant on this site, featuring four different assembly lines (one for each of their truck categories is visualized. This plant would serve to centralize all assembly operations to leave space at the Fort Wayne (Ind.) Works for an expansion of manufacturing facilities. Consideration is also being given to the possibility of expanding facilities for West Coast models.

There is a major project for the introduction of new production equipment to expand current facilities. Two large Danly presses were installed recently at Springfield for the production of large body stampings, such as roof panels and side panels. Fort Wayne is in the process of installing new machine tools for making heavy-duty axles.

At Indianapolis, where most engines (including V-8's) are produced, IHC is adding 40,000 sq ft to the plant and expanding machine tool facilities for the V-8 engines. When this project is completed, it will permit doubling of V-8 engine production.

### Ford Savings-Stock Program Exceeded $23 Million In '56

Contributions by Ford Motor Co. and its salaried employes to the company's savings-stock investment program totaled about $23.4 million in 1956. The total includes approximately $15.8 million contributed by the employes and approximately $7.6 million by the company.

Under the program, an eligible salaried employe each year may contribute up to 10 per cent of his base salary and cost-of-living allowance, with a limitation of $2000 per year. Each employe may elect one of two plans—the savings plan or the stock investment plan.

Under the savings plan, half of the employe's contribution is invested in U. S. government bonds and half in Ford common stock.

The stock investment plan offers an employe the option of placing half of his contribution in government bonds and half in Ford common stock, or having his entire contribution invested in stock. The company's contribution of 50 cents for every dollar contributed by an employe is invested entirely in company stock.

### Special Equipment Increases Capacity of Chevrolet Trucks

Maximum capacity rating on Chevrolet's middleweight trucks can be increased from 19,000 to 21,000 lb with new special equipment now being made available. Package includes 283 cu in. V-8 engine, 16,000-lb rear axle, 7000-lb front axle, and heavier-duty front and rear springs and tires.

### Two Air Force Contracts Given Continental Motors

Continental Motors Corp. recently received two Air Force orders totaling approximately $17 million. One, valued at $9.1 million, is for improvement on the J-69 gas turbine engine used in military training aircraft. Valued at $7.8 million, the second order calls for "Packette" engines and engineering data.

### Safety Council Cites GM For Record In '56

General Motors Corp. in 1956 achieved the best safety record in its 49-year-history. The company earned its 12th "Award of Honor" in the past 15 years, according to the National Safety Council. Of GM's total 500,000 employes in the U. S. and Canada, 99.8 per cent lost no working time during 1956 as a result of an occupational illness or on-the-job accident.

The company-wide accident frequency rate (number of disabling injuries per million manhours worked) in 1956 was 1.2. This was an improvement of 54 per cent over the average for the previous 10 years. The 1956 severity rate (number of days lost per thousand hours worked) was .21, a 50 per cent improvement.

### Further Details Disclosed On Earth Satellite Rocket

New details of the construction and operation of the earth satellite launching rocket have been revealed by Glenn L. Martin Co.

The first-stage propellant tanks are of welded aluminum, while those in the second stage are of stainless steel. The rest of the second stage skin is magnesium thorium—a relatively new material. The nose cone is constructed in halves of a molded asbestos phenolic material with a titanium tip.

The first-stage engine will be free to swivel a little more than three deg in any direction, thus changing the course of the vehicle toward the opposite direction. To control the "roll" of the rocket, small rotating jets will be used. The jet nozzles are capable of being rotated in less than a tenth of a second by solenoid-controlled pneumatic actuators.

### Injury Rates Kept Low At Ford Plants In '56

Last year turned out to be one of the safest years on record for Ford Motor Co. employes. The on-the-job injury frequency rate was reduced to 1.43 for each one million manhours worked. The injury-severity rate totaled only 270 lost days per one million man-hours work.

The Chicago Aircraft Engine Div. reported the best record for the year of all Ford divisions. It had a frequency rate of only .47 and lost time of 31 days per one million hours worked. Seven Ford plants worked through the year without a single disabling mishap.


### PIASECKI TO PRODUCE BABY HELICOPTER IN U. S.

*The Ultra-Light single-rotor, jet-powered helicopter, developed by Fairey Aviation Co., Ltd., has been introduced in the U. S. by Piasecki Aircraft Corp. It is under evaluation by the Defense Dept. for troop mobility, and Piasecki has an option to manufacture it. The propulsive system of pressure jets at the rotor blade tips is said to permit easy maintenance. Palouste engine, a turbine air compressor designed by the French Turbomeca Co., is also produced in England by the Blackburn Co. and by Continental Aviation Engine Corp. in the U. S. for several military applications.*

### Aluminum Dump Bodies Proving Popular in Roadbuilding Uses

Aluminum dump bodies for large earthmoving equipment are expected to become increasingly popular among roadbuilders. Alcoa is doing an active promotion job working with truck makers, body builders, and contractors to demonstrate payload advantages of the light metal bodies.

Reduced tare-weight permits hauling up to 25 or 30 per cent more dirt and cuts operating cost per yard. Another advantage is that fewer vehicles can move the same cubage of dirt because of the aluminum bodies.

### Westinghouse Sales Show Rise As Earnings Declined in 1956

Net sales billed by Westinghouse Electric Corp. for 1956 totaled $1,525,375,000, an increase of six per cent over 1955.

Income for 1956, before giving effect to the LIFO (last-in, first-out) method of inventory evaluation, was $15,537,000, compared to net income of $42,803,000 at the end of 1955. Net income for 1956, after applying the LIFO method of inventory evaluation, was $3,492,000.

### Sales of Heavy-Duty Trucks This Year Could Match 1956

Bolstered by the new highway-building program, heavy-duty truck sales this year could easily equal the 1956 total. That optimistic report comes from Robert F. Black, chairman of White Motor Co.

Mr. Black notes that more than $600 million of trucks in the 19,500 GVW and above class were sold last year. The figure was about 12 per cent above 1955.

### Allis-Chalmers Sales Rise; Profit Dips To $20 Million

In spite of a $12 million increase in sales last year, earnings of Allis-Chalmers Manufacturing Co. declined to $20.3 million from $24.8 million in 1955. Sales last year totaled $547.4 million, compared with $535.1 million in the preceding 12-month period. Assets increased from $445.7 million to $513.9 million.

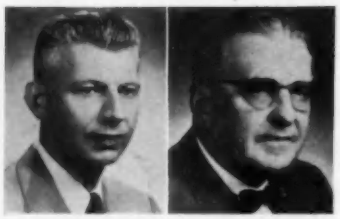
### Truck Production Starts Upward After Long Lull

Truck production, down about 12 per cent in the first quarter under the like 1956 period, is now heading upward. High output by the industry last month (April) may trim that deficit.

### Correction

It was erroneously stated on page 33 of the April 15 issue that Ford Div. had set a price of $2962 on its Skyliner retractable hardtop convertible. Later information indicates a suggested list price of $2702, exclusive of Federal taxes, transportation, or dealer preparation charges, with an eight-cylinder engine. Target for the current model run is in excess of 20,000 units.

# Men in the News



*Snyder Tool & Engineering Co.—Leo P. Gajda and Bruce M. Regan were named vice-president for engineering and vice-president for manufacturing, respectively.*

*Bullard Co. — William C. Neu has been made advertising manager.*

Chevrolet Motor Div., General Motors Corp.—**M. S. Rosenberger** has been named assistant chief engineer in charge of engine and passenger car chassis design; **Max M. Roensch,** assistant chief engineer in charge of experimental test operations; **Nelson E. Farley,** director of experimental laboratories; and **George A. Brundrett,** director of proving ground activities.

Motch & Merryweather Machinery Co.—**Louis Reiss** has been appointed treasurer.

Rochester Products Div., General Motors Corp.—**Robert W. Decker** was named division works manager to succeed **Charles C. Brandon,** now director of production and material control and purchasing.

Allis-Chalmers Mfg. Co. — **Henry Larsen** is now assistant general works manager for the Tractor Group.

Behr-Manning Co.—**Henry R. Merrill** has been appointed vice-president in charge of sales.

Mercury Div., Ford Motor Co.—**E. A. Erickson** has been appointed national parts and service manager; **Richard S. Hanel,** parts and accessories operations manager; **R. R. Nadal,** central regional sales manager; **A. H. Crawley,** dealer affairs manager; and **J. R. Maroni,** marketing analysis and planning manager.

**Kaiser Aluminum & Chemical Sales, Inc.**—**Robert C. Bichan** has been made automotive industry sales manager, succeeding **M. C. Crockett,** now assistant to the vice-president and general sales manager.

**Borg-Warner Corp.** — **William A. Valiant** has been elected assistant treasurer.

**Ohio Crankshaft Co., Crankshaft and Camshaft Div.**—**H. J. Louth** was made works manager, and **Ben M. Kozman, Jr.,** was promoted to personnel director.

**Dole Valve Co.**—**John J. Goodwillie** and **James K. Lund** have been appointed vice-presidents.

**Eaton Mfg. Co., Valve Div.**—**Howard R. Johnson** was promoted to assistant general manager.

**Cummins Engine Co., Inc.**—**N. M. Reiners** was named vice-president of research.

**Bendix Aviation Corp., International Div.**—**Theodore Voorhees** has been appointed general manager.

**Oldsmobile Div., General Motors Corp.**—**William J. Slachta** has been appointed superintendent of the final assembly plant.

**Aircooled Motors, Inc.** — **Howe H. Hopkins** has been named chief engineer.

**Sterling Engine Co.** — **Richard L. Gates** has been appointed chief engineer.

**U. S. Steel Export Co.**—**William S. Morrison** has been appointed president.

**General Electric Co.**—**Eugene M. Beattie** was made manager of executive aircraft operations.

*E. W. Bliss Co.—Charles H. Schwerin was made manager of West Coast sales for the Mackintosh-Hemphill and Rolling Mill Divs., and James K. Wingard was chosen manager of engineering for the Press Div.*

*J. J. Tourek Mfg. Co.—William D. Ross was appointed president, and R. A. Burritt was named vice-president and factory manager.*

*Babcock & Wilcox Co.—M. Nielsen has been elected president.*

## Necrology

**Carl J. Bock,** 62, retired chief engineer of GMC Truck & Coach Div. of General Motors Corp., died Apr. 2, at Pontiac, Mich.

**Gail I. Middleton,** 62, secretary of the Freight Rate Committee of the Automobile Manufacturers Association, died recently, at Detroit, Mich.

**George A. Fryberg,** production manager of the Abrasive Div. of Norton Co., died Apr. 6, at Shrewsbury, Mass.

**Leonid A. Umansky,** 66, retired manager of industrial engineering for General Electric Co., died Apr. 3, at Schenectady, N. Y.

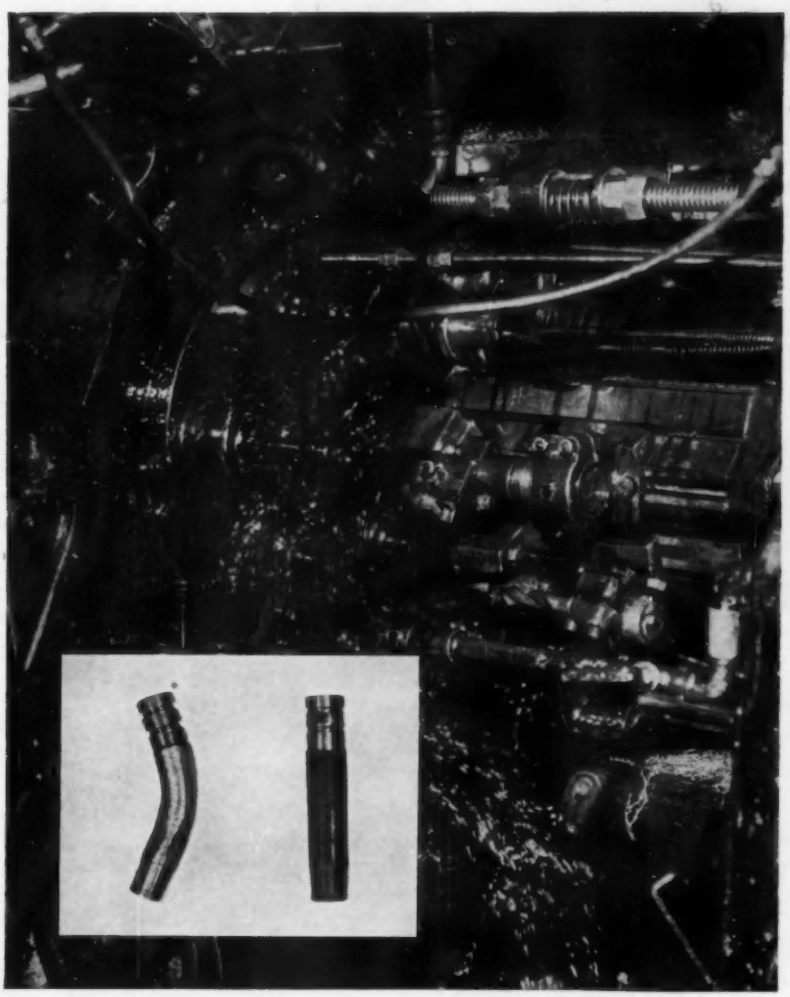
**Charles J. Reimer,** 46, general purchasing agent of SKF Industries, Inc., died recently, at Philadelphia, Pa.

**Thomas H. MacDonald,** 76, retired chief of U. S. Bureau of Public Roads, died Apr. 7, at College Station, Tex.

**Leo Donovan,** 53, well-known automotive writer for the *Detroit Free Press,* died Apr. 6, at Detroit, Mich.

# "We get better finish and die threads last longer

## ...with Texaco Sultex Cutting Oils," says Cormier & Shaver Mfg. Co., Cleveland, Ohio



Machining carbon steel parts on New Britain multiple spindle automatics.

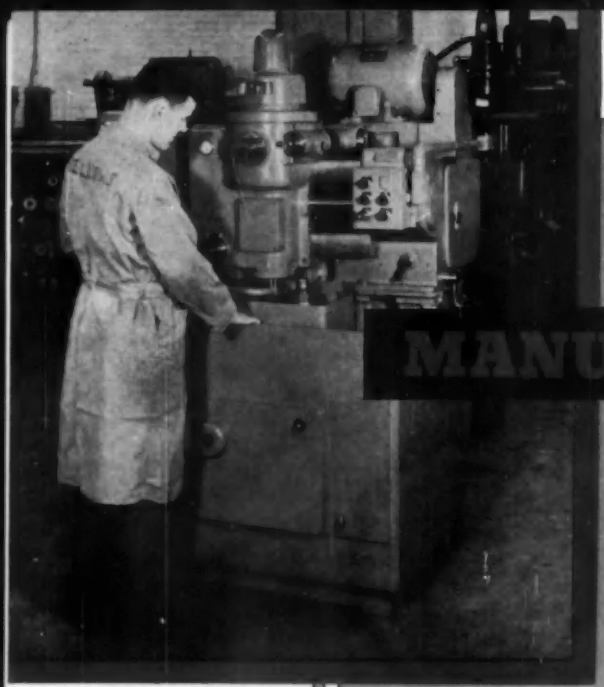
"We are a job shop," continues this customer, "and we machine many different types of steel. But our most demanding operation is the threading of automobile car heater parts from SAE 1010 carbon steel. We need a cutting oil that will provide a fine finish, and that will give us good die thread life. For several years now, *Texaco Sultex Cutting Oil A 2* has been doing an outstanding job for us."

There is a complete series of *Texaco Cutting Oils* to handle your toughest jobs in high speed cutting, broaching, threading and tapping. Let your Texaco Lubrication Engineer suggest the proper ones to help you do all your machining most efficiently, and at lowest cost. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

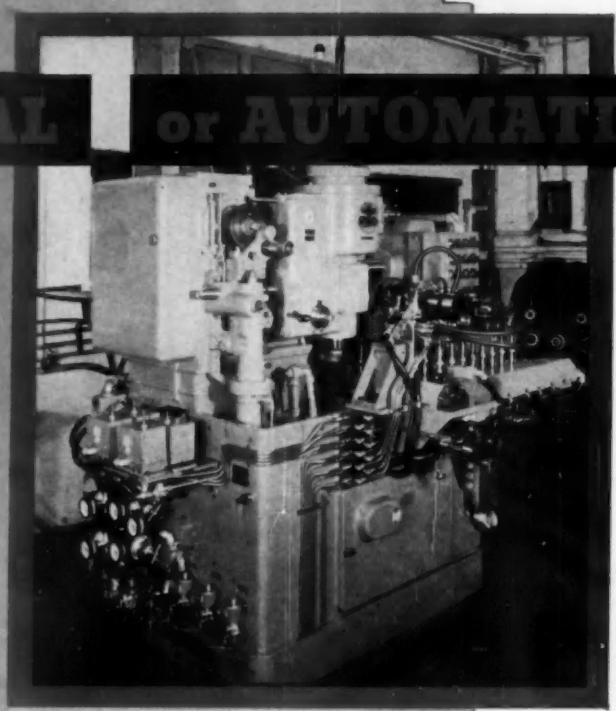
TEXACO

**TEXACO** CUTTING, GRINDING, SOLUBLE AND HYDRAULIC OILS



# VERSATILE

## MANUAL or AUTOMATIC



Practically any shaped part in its size range can be cut faster and more accurately on a Fellows No. 4GS Gear Shaper . . . with either manual, semi-automatic or full-automatic operation, depending on your needs!

This production flexibility makes the powerful "4GS" ideal for long runs on similar parts or for short runs of varied jobs. Set-ups are easy and fast. Internal or external spur and helical gears, as well as splines, cams and other irregular non-involute shapes up to 6" P.D. and 2" face width can be cut on this machine. Nine cutter speeds range from 98 to 635 strokes per minute.

The versatility of Fellows No. 4GS Gear Shaper, with manual operation or any degree of automation, can very probably lower *your* cutting costs. Ask your Fellows Representative to show you facts and figures. Write, wire or phone any Fellows office.


THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
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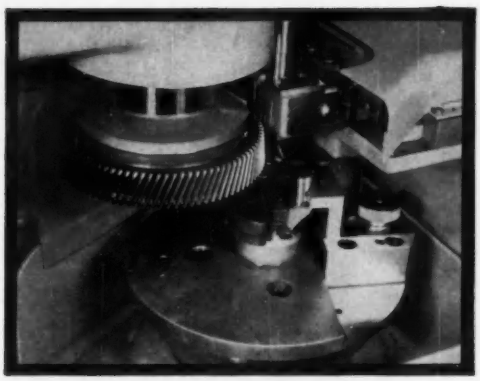
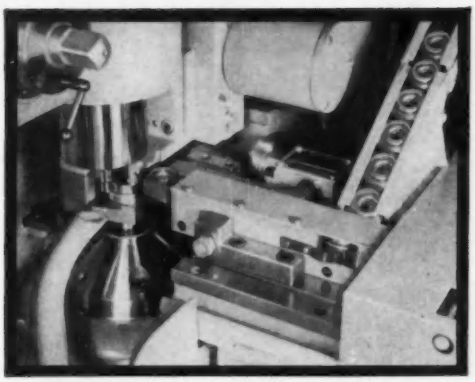
THE PRECISION LINE

# FELLOWS "4GS"

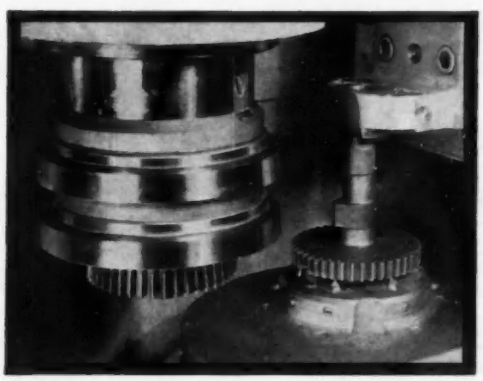
# ...or anything in between!



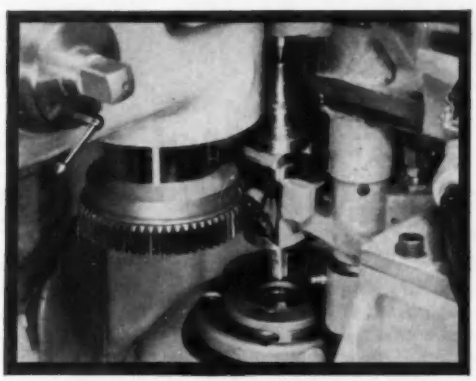
**Helical gear** cut on a motor crankshaft. Operation can be manual or semi-automatic. Part is held in a bushing at the bottom, an air operated split sleeve support at the top and driven from the connecting rod bearing surface.



**Internal clutch parts** produced with fully automatic loading and unloading. Part is transferred from loading chute to air operated expanding arbor and teeth are cut. Part is then removed from arbor and transferred to unloading chute while another blank is being loaded.



**Two cams and a gear** are cut at the same time on this gasoline motor part. Cutters are used in tandem and are keyed together to give the required relation between the positions of the cams and the teeth of the concentric gear. Operation is manual.



**Automotive transmission cluster gear shaft** handled automatically. Air operated "fingers" move shaft into position for automatic chucking and then place finished part in unloading conveyor.

*Fellows* *Gear Production Equipment*

# Graph-Mo® dies cut downtime 50% on deep draw for round vacuum cleaner!

ENGINEERS at The Hoover Company had a tough problem in getting that round vacuum cleaner shape in the new Constellation. The two circular dies that form the hemispheres often galled, picking up bits of the steel being formed. This scored the dies, marred the finished parts. Production had to be shut down while the dies were repolished. And extra polishing of the hemispheres ran up costs still more.

After studying the problem, Timken Company metallurgists recommended dies made from Graph-Mo®—a special tool steel developed by the Timken Company. Results were outstanding. The new Graph-Mo dies cut downtime 50%. The combination of free graphite particles and diamond hard carbides in its structure make it outwear other tool steels 3 to 1. Production rolled smoothly and refinishing time was cut.

Graph-Mo machines 30% easier than conventional tool steels. And its uniform response to heat treatment eliminates distortion—saves time and money in lots of tough jobs.

Graph-Mo is one of four graphitic tool steels developed by the Timken Company. If you would like more information about their uses in dies, punches, gages and machine parts, send for the new Timken Graphitic Steel Book. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

**TIMKEN** *Fine Alloy* **STEEL**

TRADE-MARK REG. U.S. PAT. OFF.

**SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING**

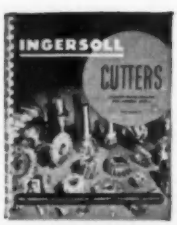

Ingersoll Shear Clear Cutter
27800 series... Pat. No. 2168417
Page 14, Catalog 66

# Feed rate increased 2½ to 5 times at Vaughn with this INGERSOLL SHEAR CLEAR® CUTTER

The cutter previously used was nullifying the investment in a new standard, knee-type milling machine. The machine had more power than was being utilized. The feed rate was only 12″ per minute. The change to Ingersoll Shear Clear permitted the Vaughn Machine Company, Cuyahoga Falls, Ohio, to capitalize on its machine investment and obtain the economy and efficiency of increased feed rate. A feed range of 30″ to 60″ per minute, when milling rough forgings and steel castings, is now continuously maintained.

Ingersoll inserted blade cutters are used on all makes of machines for milling and boring a wide range of materials. An Ingersoll Cutter Division representative will be glad to discuss this and other feed rate experiences with you.

Whether you are concerned with feed rates, longer tool life, finish or cutter costs, the new Ingersoll cutter catalog will be a valuable guide. Write Department 66I.




Use this new 82 page guide for selecting the right inserted blade milling and boring cutters for your work. Write for catalog #66, today.

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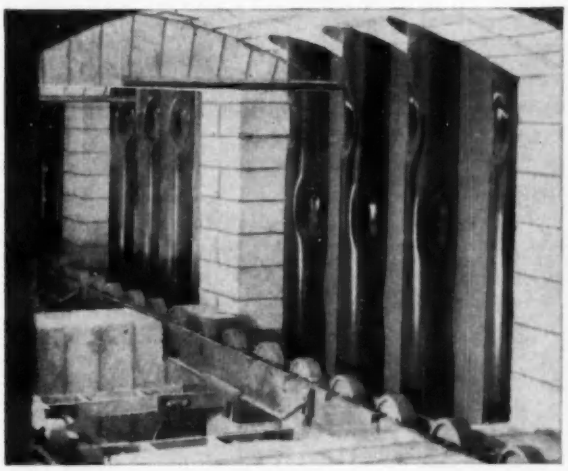
## CUTTER DIVISION

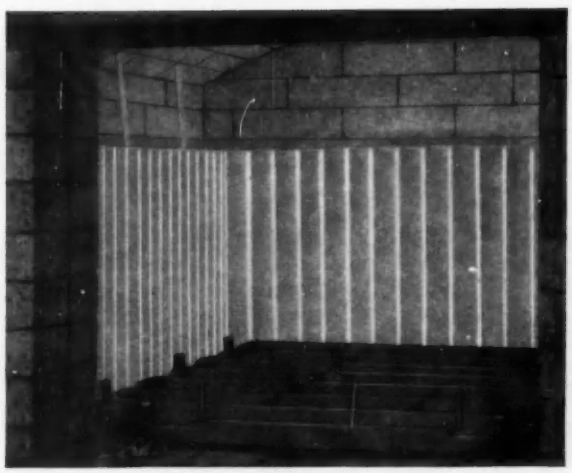
**THE INGERSOLL MILLING MACHINE COMPANY**

ROCKFORD ILLINOIS

*Whatever your source of heat...*

# LINDBERG HEAT TREATING FURNACES OFFER THESE EXCLUSIVE ADVANTAGES





**. . . IN THE GAS-FIRED FURNACE**

## NEW LINDBERG VERTICAL RADIANT TUBE

Because of its revolutionary design, this tube provides a new level of gas-fired furnace performance. The secret lies in the new Lindberg tube's "dimples." The tube carries a central stream of mixed air-and-gas surrounded by a cylindrical stream of air alone. Combustion occurs in the area between these two streams. The "dimples" create eddies accelerating combustion and maintaining even temperatures along the entire tube.

This Lindberg tube will operate at maximum efficiency for a longer period of time. The special protective coating gives greatest possible resistance to carbon penetration. Vertical position eliminates soot deposit and resultant temperature increases at points of sooting.

Tubes are 59 inches long, weigh only 29 pounds, changeable in a few minutes. No costly furnace shutdowns nor high labor and material cost for tube changes.

**. . . IN THE ELECTRIC FURNACE**

## NEW LINDBERG CORRTHERM ELEMENT

CORRTHERM, Lindberg's radically advanced new electric heating element offers advantages never before available for heat treating furnaces. With this new element carburizing and carbonitriding with electricity becomes practical, efficient and economical. Ideal, too, in other types of Lindberg electric furnaces.

The outstanding feature of the CORRTHERM element is the extremely low voltage at which it operates. Consequently, leakage through carbon saturation and shock or short hazards are eliminated. Elements also act as baffles to direct circulation of convection streams.

CORRTHERM elements are practically indestructible. Work load or operator's charging tool can't hurt them. Watts density is at all time low. Easily installed or replaced, too, as element merely hangs in furnace and no complicated mountings are required.

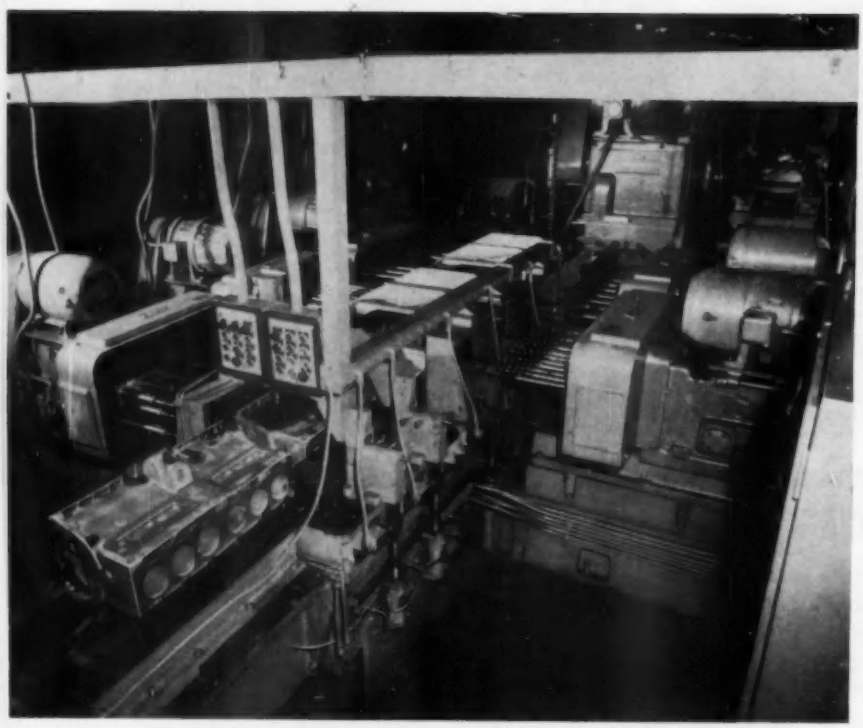
**Lindberg Field representatives in 21 cities are ready to show you how Lindberg furnaces with these revolutionary new elements can improve your heat treating process. You'll find your Lindberg representative's name in the classified section of the phone book or write us direct.**

**LINDBERG FURNACES**

**LINDBERG ENGINEERING COMPANY**
**2491 W. Hubbard Street • Chicago 12, Illinois**

# Flexible Equipment for Making Wide Variety of Engines

By
Joseph Geschelin



*Perspective view of the first transfer machine in which all top and bottom holes are drilled. In the foreground may be seen the W. F. & John Barnes heads supplied for many of the stations.*

*Close-up of one of the stations in a transfer machine with a six-cylinder block seen entering the first station of the top and bottom drilling operation. The steel guide bar in the center is about to pick up the milled channel for accurate alignment. This view also shows the cluster plate with its quick-change spindles.*

LAST year (see AI, January 1, 1956) Hercules Motors Corp. announced the initial development of a line of heavy duty engines which is now available in a series of 3-cyl, 4-cyl, and 6-cyl enbloc models in three bore sizes for each block. Featuring maximum interchangeability of major elements, these engines are available in spark or compression ignition versions.

From an engineering standpoint, this unified design promotes maximum economy of the product for the benefit of the user since service and replacement parts stocking has been simplified so greatly.

From the manufacturing standpoint, the pressing problem was to develop modern mass production methods and special equipment which, at the same time, would have the necessary flexibility to assure cost economy. As will be illustrated later, this was realized to the maximum degree in the case of the cylinder block machine line. Composed largely of transfer machines and single-purpose machines, it has been arranged in such fashion as to permit the machining of 3-, 4-, and 6-cyl blocks over the same equipment without change in fixturing. The individual types of blocks are scheduled in economic lot sizes, the only change in setup being in the number of spindles used on each head.

Cylinder heads are handled in similar fashion, using smaller special purpose drilling machines and

simpler milling machines. One of the special features on this line is the use of Sundstrand magnetic plates for holding the work. They are sufficiently powerful to hold heads even under extremely heavy milling cuts.

Equipment on both the cylinder block and cylinder head lines is noteworthy for an unusual degree of flexibility. The cylinder block transfer machines and other items of equipment will handle the entire range of blocks—3, 4, and 6-cylinder—in economic lots or batches with only minor changes required in tooling. Each station of a transfer machine is provided with large multiple-spindle heads, containing the maximum number of quills that may be required for the largest block, the quills being properly located as to the desired spacing. All that is necessary then to convert a machine from one block to another is to apply the required number of spindles in the proper location.

Generally speaking, neither the cycling nor fixturing of the machines is affected since the fixtures on milling and boring equipment will handle all block sizes. On the transfer machines, the transfer mechanism has a series of three dogs at each station, one for each length of block, and the proper dog spacing is readily effected at the time of changeover.

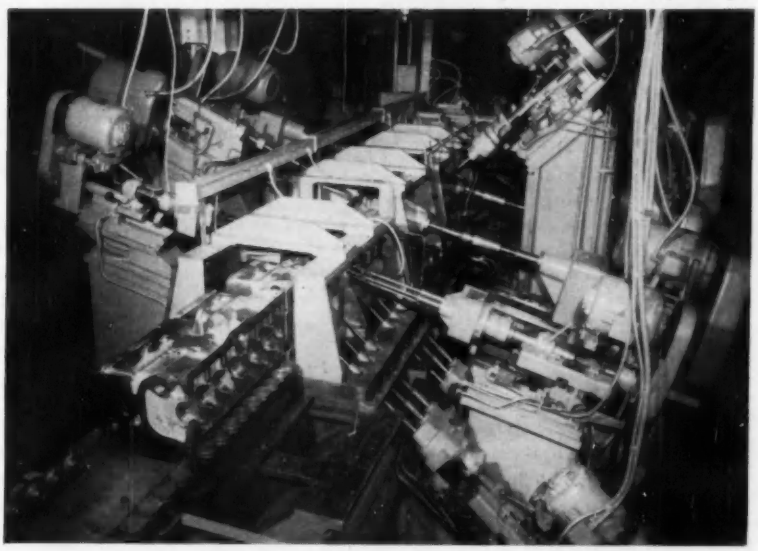
On the cylinder head line where it is necessary to handle at least six different heads, the heads for gasoline and Diesel engines differing in detail, the work holding fixtures are of universal design. For example, each fixture is arranged with two holding stations, one over the other, one for gasoline engine heads, the other position for Diesel engine heads.

Altogether the arrangement was thoughtfully developed by advance planning not only for flexibility but simplicity of changeover and maximum economy from the standpoint of relatively small volume as compared with automobile practice.

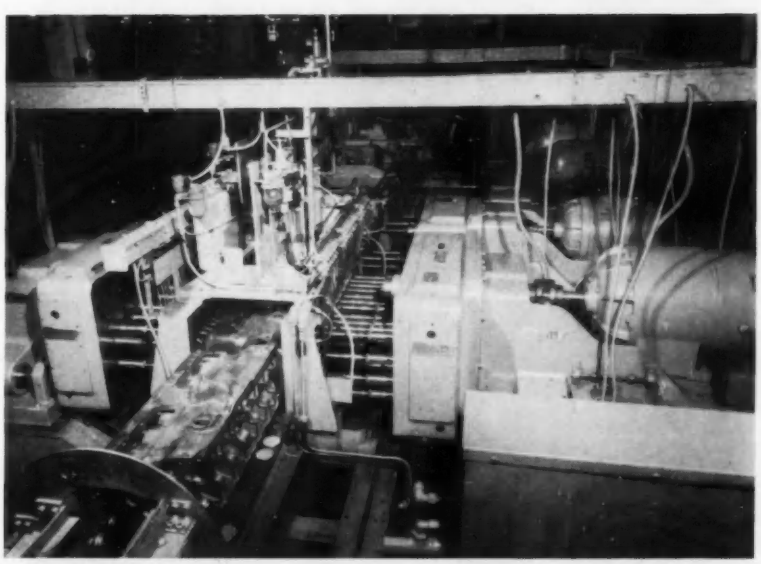
Consider now the sequence of operations on a typical cylinder block, the one selected here being a four-cylinder block. Because of the usual multiplicity of operations, we shall touch only on a selection of major steps, concentrating primarily on those illustrated here.

First operation is the rough-milling of top, bottom, main bearing channel, and two side cover plates. This, as well as finish-milling of the same faces, is done in Ingersoll mills, using replaceable carbide blades in the Shear-Clear milling cutters.

This brings us to the first multi-station transfer machine which is



*Unloading end of one of the transfer machines. This one handles the drilling of angular holes; bores and faces oil pump and injection pump holes.*

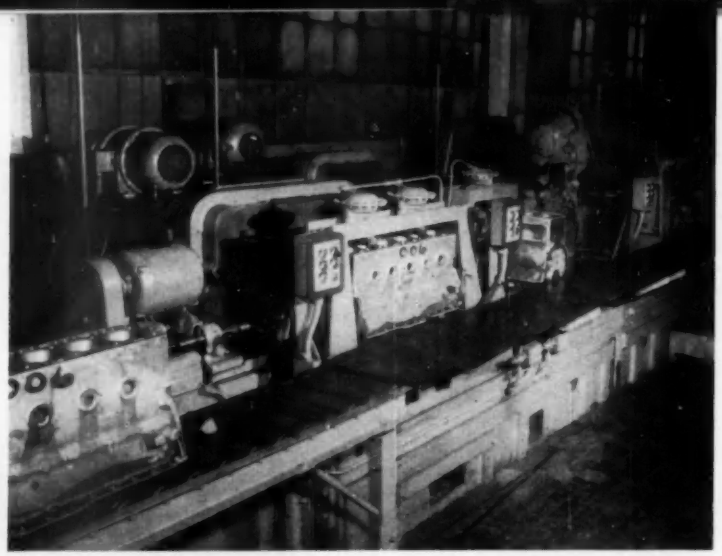


*Unloading end of the transfer machine that finishes valve tappet holes and taps all holes in top and bottom faces. This is an example of some of the special tooling supplied by U. S. Drill Head. In the foreground is a typical rollover fixture.*

built up of W. F. & John Barnes hydraulic units and US drill heads. The first station drills 19 holes in the bottom face. The second station drills 26 holes, reams two in the bottom; and drills 16 holes in the top. The next station drills 28 holes in the bottom, 20 holes in the top.

At this point the blocks leave the transfer machine for a series of operations. Ends are milled in a Cincinnati Hydromatic Duplex mill, then the cam hole is core-drilled in a two-way Natco horizontal drilling machine. The block then moves to a single spindle Natco horizontal boring machine for rough-boring the main bearing line. Following this the cam line is semi- and finish-bored.

Main bearings are milled to length in a Newton rise-and-fall type straddle mill with hydraulic feed. Then the cylinders are rough-bored in one of the familiar Moline multiple-spindle boring machines. This one is fitted with a Davis boring bar attachment on one side to combination drill and spotface the tachometer hole at the same time. This is an example of the skillful improvisation employed at Hercules. Another one is the use of a Baker vertical drill fitted with a special milling head attachment for milling the pads on the valve side.



*Perspective view of a portion of a transfer machine on which sides and ends of cylinder blocks are drilled. Here may be seen the application of air cylinders for clamping the work.*

Next in line is the second multi-station transfer machine, employing a variety of W. F. & John Barnes hydraulic heads. The first station drills 12 valve tappet holes; the second drills two large diameter angular holes, as well as six small oil gallery holes, the latter being done with angularly-mounted drill units. At the next station, the oil pump hole is semi-finish-bored and reamed to a total tolerance of 0.0005 in., the pad is finish-faced, and the distributor hole is bored and reamed to a total tolerance of 0.001 in. At the same time the breather hole is bored and counterbored with a total tolerance of 0.001 in.

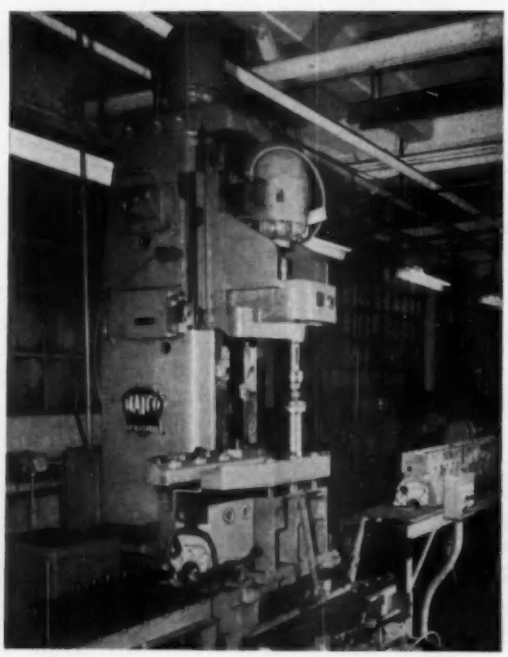
The last station drills and countersinks a group of six holes and the work is transferred to the third machine by means of a special rollover conveyor section. This station rough-reams the eight valve tappet holes.

The fourth transfer machine drills 15 holes in the valve side; then 19 holes in the front end and on the water side. The next station drills one hole and combination bores, reams, and faces three 1.500 bores, holding to a tolerance of 0.001 in. The next station drills 22 holes in the rear end.

This is followed by a setup in a trunnion fixture for chamfering all tapped holes in the top, rear, and front, and 18 holes in both sides at the next station.

Next in line is a multiple-spindle tapping machine for tapping 19 holes in the rear end; and another machine for tapping 16 holes in the front end.

The block then is returned to the third transfer machine for tapping 10 holes in the bottom side; tapping 14 holes in the top; and 26 additional holes in the bot-



*This shows the adaptation of a standard Natco vertical drilling machine for chamfering the bottom faces of cylinder bores. The fixture is of universal type and the machine is controlled hydraulically for automatic cycling and indexing of bores.*

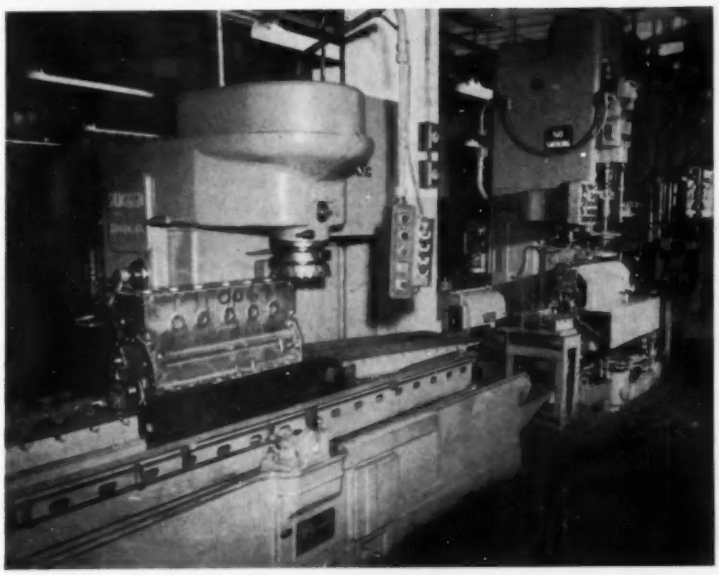
tom. At the last station the eight tappet holes are reamed to a tolerance of 0.0006 in. The valve tappet holes then are bearingized; and the main bearing slot finish-broached.

Skipping some of the intervening operations, the block begins to approach the end of the line. Bores are precision-bored in an Ex-Cell-O machine, the main bearing caps are installed, and the main bearing line is finish-bored. The top face of the block then is finished-milled in a Sundstrand vertical mill to make ready for honing.

These blocks require a chamfer in the bottom edge of the cylinder bores, again providing an excellent example of improvisation. The operation is fast and the volume of production does not justify a multiple-spindle machine. So they set up the Natco drilling machine, illustrated here, fitted it with a suitable expanding boring bar and provided a fully automatic cycle. The single-spindle setup has no difficulty in keeping up with the rest of the line.

Honing of cylinder bores is done

(*Turn to page* 117, *please*)



***Top—Perspective of a portion of the cylinder head machine line. Here may be seen the variety of individual single purpose machines for the various operations. In the background at the right is one of the units for angular drilling, using a universal fixture set at an angle of 40 deg.***

***Center—This is the group of machines at the final end of the cylinder block line. In the foreground is the massive Sundstrand Rigidmil for finish-milling the top face prior to honing. Next in line is the Barnesdril Plugmatic type honing machine of single spindle type. In the background is the Natco vertical drill tooled up for chamfering the top face of cylinders when fitted with sleeves.***

***At right—View of the assembly line showing the power driven conveyor chain and the universal type pallets. At the time this photograph was taken the line was filled with a mixture of all types of engines.***

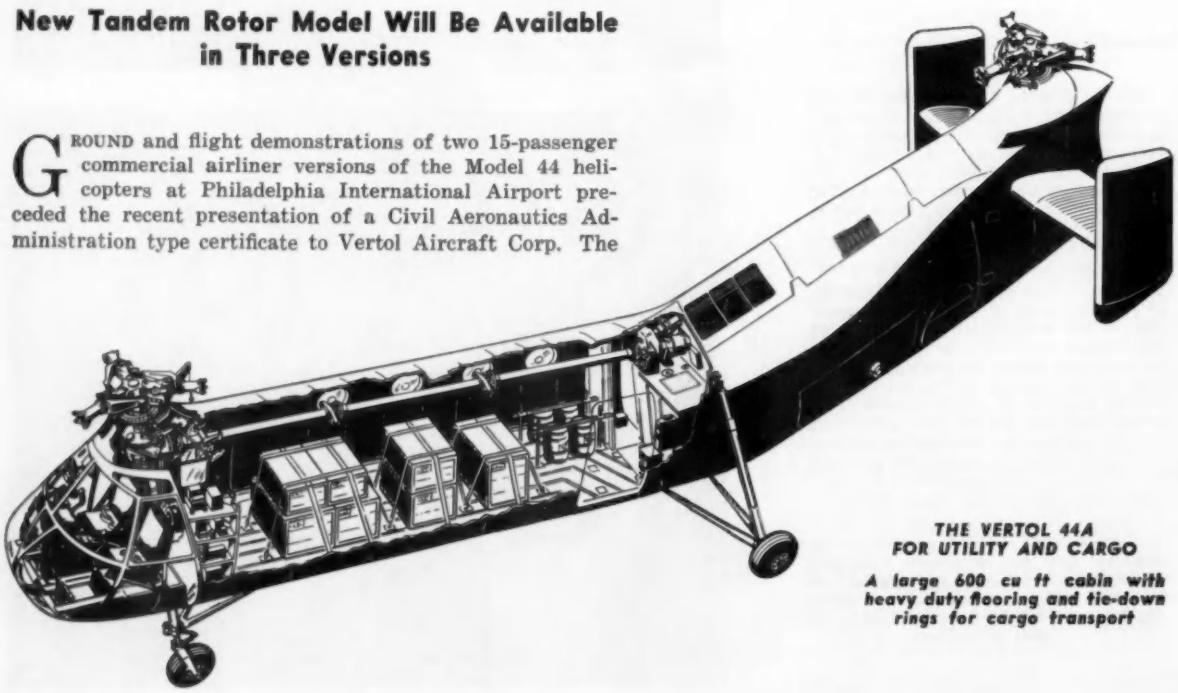
# The VERTOL Commercial Helicopter

**SPECIFICATIONS AND PERFORMANCE**

| | |
|---|---|
| **PERFORMANCE:** | |
| Maximum Speed (At Sea Level) | 126 mph |
| Cruising Speed | 100 mph |
| Maximum Rate of Climb (Sea Level) | 1050 fpm |
| Effective Range (With Standard Fuel Reserve) | 360 miles |
| Fuel Consumption (Cruising) | 75 gph |
| Hovering Ceiling in Ground Effect | 5000 feet |
| Hovering Ceiling out of Ground Effect | 3500 feet |
| **SPECIFICATIONS:** | |
| Gross Weight— | |
| Normal | 14,000 lb |
| Military | 15,000 lb |
| Useful Load— | |
| Normal | 5345 lb |
| Military | 6345 lb |
| Engine Ratings (Wright Cyclone)— | |
| Take-Off (At 2700 rpm at 2000 ft) | 1425 bhp |
| Normal (At 2500 rpm at 3500 ft) | 1275 bhp |
| Maximum Cruise (At 2400 to 2500 rpm) | 800 bhp |

## New Tandem Rotor Model Will Be Available in Three Versions

GROUND and flight demonstrations of two 15-passenger commercial airliner versions of the Model 44 helicopters at Philadelphia International Airport preceded the recent presentation of a Civil Aeronautics Administration type certificate to Vertol Aircraft Corp. The



**THE VERTOL 44A FOR UTILITY AND CARGO**

*A large 600 cu ft cabin with heavy duty flooring and tie-down rings for cargo transport*

type certificate authorizes commercial use of the aircraft, an improved version of the company's H-21 "Work Horse" military helicopter. The new tandem rotor helicopter is available for delivery this summer to commercial operators in three versions:

Model 44A for utility passenger-cargo operations. The seat arrangement permits the transportation of 19 passengers in civilian use and 20 in military service. The 600-cu ft cabin can accommodate 50 per cent more cargo than any other commercial helicopter. Bulky items can be carried externally on a 2½-ton cargo sling. Model 44B for commercial passenger service, seating 15 in luxurious airliner comfort and providing a 50-cu ft mail, cargo and express compartment. Model 44C for deluxe executive transport in business and industry.

Seats in passenger helicopters can be folded against the walls for partial or full conversion to a cargo carrier.

The main cabin door is of clamshell design, with built-in passenger steps and handrail. A second door at the front of the cabin facilitates loading and unloading when the helicopter is used to carry cargo.

Passengers who wish to carry their own baggage may stow it in a cabin luggage rack which runs the length of one side of the interior.

The Vertol 44's cabin is a constant cross-section area 20 ft long, 5½ ft high and 5 ft, 8 in. wide.

The cabin is sound-proofed throughout and the noise level is comparable to a modern fixed-wing aircraft.

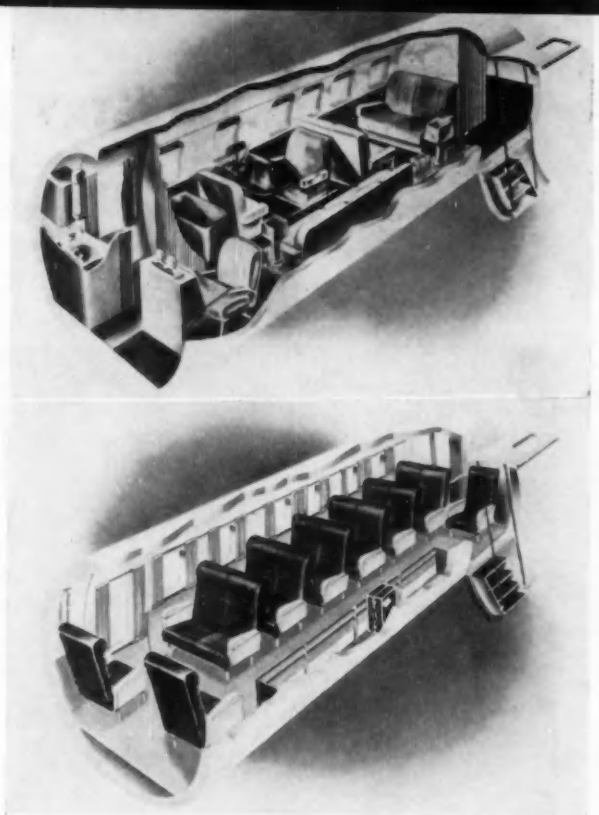
The seven-ton helicopter has a useful load of 5345 lb, and its cruising speed is over 100 mph with a range, with standard fuel reserve, of 360 miles.

The helicopter is powered by a Wright Cyclone reciprocating engine with a take-off rating of 1425 hp. When available commercially, twin turbine engines will be used. The present models of the Vertol 44 are so designed that their engines can be replaced by twin turbines with only minor modifications.

A two-speed engine supercharger provides superior high-altitude performance in mountainous regions. For example, the helicopter is capable of taking off from a 12,000-ft elevation with a 3000-lb payload and carrying it 100 miles maintaining the same altitude. The Vertol 44 can operate up to 19,000 ft with lower payloads for the same distance.

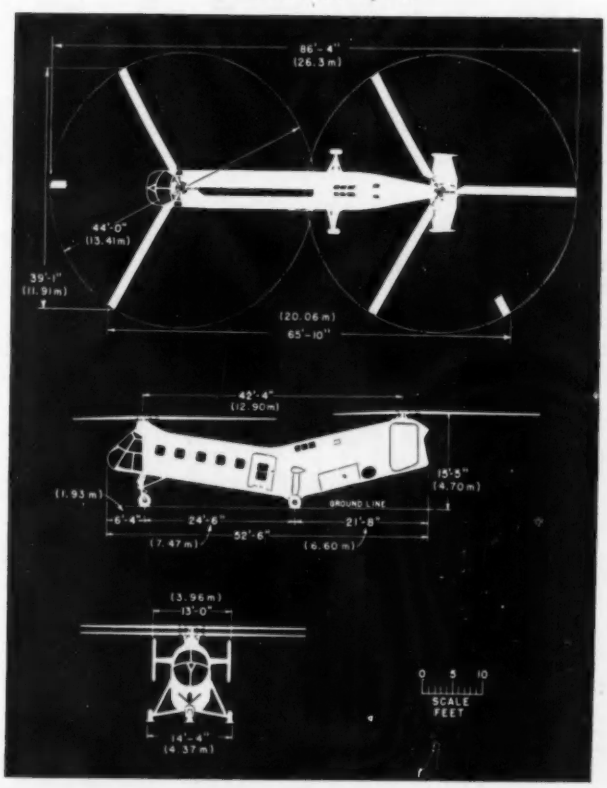
Direct operating cost of the Model 44, 15-passenger model, based on an 800-hr minimum annual use and 100-mile block operations, will be about 11½ cents per seat mile. With an annual utilization of not less than 2000 hr but with the same block distance, the seat-mile cost will be a little more than seven cents.

Special floats can be attached to convert the new helicopter for water-based operations, such as serving off-shore oil rigs.



*Vertol's new commercial helicopter is available in three styles, two of which are shown here. Model 44C (top) features a custom-fitted deluxe interior for executive transport in business and industry. (Bottom) Model 44B is designed for commercial passenger service and seats 15 in its comfortable airline interior. The seats can be folded away or removed for rapid conversion to partial or full cargo transport.*

*Three-view drawing of the Vertol 44, a 15- to 19-passenger commercial helicopter.*



# . . INDUSTRY STATISTICS . .

## 1957 WEEKLY U. S. MOTOR VEHICLE PRODUCTION

*As reported by the Automobile Manufacturers Association*

| Make | Weeks Ending April 13 | Weeks Ending April 6 | Total—Year to Date 1957 | Total—Year to Date 1956 |
|---|---|---|---|---|
| **PASSENGER CAR PRODUCTION** | | | | |
| Hudson | 78 | 82 | 847 | 3,626 |
| Nash | 118 | 133 | 1,923 | 9,556 |
| Rambler | 2,151 | 2,142 | 26,624 | 32,583 |
| Total—American Motors | 2,347 | 2,354 | 29,394 | 45,765 |
| Chrysler | 2,173 | 2,759 | 44,422 | 43,687 |
| De Soto | 2,433 | 2,968 | 49,139 | 37,413 |
| Dodge | 6,686 | 6,719 | 98,133 | 62,736 |
| Imperial | 933 | 1,148 | 14,237 | * |
| Plymouth | 12,721 | 14,883 | 217,787 | 151,312 |
| Total—Chrysler Corp. | 24,916 | 28,474 | 423,648 | 292,148 |
| Ford | 30,925 | 31,138 | 491,000 | 421,915 |
| Lincoln and Continental | 895 | 916 | 16,383 | 17,633 |
| Mercury | 6,086 | 6,276 | 113,684 | 77,845 |
| Total—Ford Motor Company | 37,906 | 38,330 | 621,067 | 517,393 |
| Buick | 9,282 | 9,252 | 158,786 | 218,759 |
| Cadillac | 3,372 | 3,358 | 49,414 | 49,972 |
| Chevrolet | 30,840 | 30,776 | 465,568 | 545,161 |
| Oldsmobile | 9,005 | 8,500 | 147,881 | 170,158 |
| Pontiac | 6,893 | 7,546 | 129,005 | 133,176 |
| Total—General Motors Corp. | 59,392 | 59,432 | 950,634 | 1,114,226 |
| Packard | 232 | 261 | 5,516 | 8,056 |
| Studebaker | 1,401 | 1,467 | 18,483 | 34,454 |
| Total—Studebaker-Packard Corp. | 1,633 | 1,728 | 23,998 | 42,509 |
| Checker Cab | 86 | 129 | 1,265 | 642 |
| Total—Passenger Cars | 126,280 | 130,447 | 2,049,996 | 2,012,683 |
| **TRUCK PRODUCTION** | | | | |
| Chevrolet | 7,682 | 7,514 | 108,235 | 122,652 |
| G. M. C. | 1,216 | 1,196 | 21,966 | 31,551 |
| Diamond T | 93 | 90 | 1,231 | 1,455 |
| Divco | 80 | 80 | 1,165 | 1,320 |
| Dodge and Fargo | 1,588 | 1,703 | 25,860 | 25,892 |
| Ford | 8,561 | 8,453 | 101,123 | 96,271 |
| F. W. D. | 24 | 16 | 336 | 631 |
| International | 2,437 | 2,273 | 27,081 | 44,760 |
| Mack | 321 | 333 | 5,291 | 5,484 |
| Reo | 59 | 40 | 927 | 1,087 |
| Studebaker | 263 | 250 | 3,599 | 4,531 |
| White | 325 | 326 | 4,969 | 5,813 |
| Willys | 0 | 1,536 | 19,574 | 19,344 |
| Other Trucks | 68 | 96 | 1,355 | 1,931 |
| Total—Trucks | 22,730 | 23,878 | 322,694 | 382,712 |
| Buses | 95 | 76 | 1,178 | 1,218 |
| Total—Motor Vehicles | 149,105 | 154,401 | 2,373,858 | 2,376,613 |

*—Included with Chrysler.

## RETAIL CAR SALES BY PRICE GROUPS*

### NUMBER OF CARS

| Price Group | February 1957 Units† | February 1957 % of Total | February 1956 Units† | February 1956 % of Total |
|---|---|---|---|---|
| Under $2,000 | 572 | .13 | 83,002 | 18.77 |
| $2,001 to $2,500 | 264,751 | 61.62 | 245,883 | 55.60 |
| $2,501 to $3,500 | 125,101 | 29.11 | 95,188 | 21.53 |
| Over $3,500 | 39,288 | 9.14 | 18,137 | 4.10 |
| Total | 429,712 | 100.00 | 442,210 | 100.00 |

| Price Group | Two Months 1957 Units† | Two Months 1957 % of Total | Two Months 1956 Units† | Two Months 1956 % of Total |
|---|---|---|---|---|
| Under $2,000 | 14,535 | 1.69 | 158,407 | 18.24 |
| $2,001 to $2,500 | 513,455 | 59.65 | 481,349 | 55.40 |
| $2,501 to $3,500 | 249,500 | 29.08 | 191,175 | 22.01 |
| Over $3,500 | 80,500 | 9.38 | 37,751 | 4.35 |
| Total | 857,990 | 100.00 | 868,682 | 100.00 |

### DOLLAR VOLUME OF SALES

| Price Group | February 1957 Dollars | February 1957 % of Total | February 1956 Dollars | February 1956 % of Total |
|---|---|---|---|---|
| Under $2,000 | 873,444 | .08 | 160,690,149 | 15.62 |
| $2,001 to $2,500 | 587,512,572 | 53.13 | 527,588,842 | 51.29 |
| $2,501 to $3,500 | 355,888,042 | 31.64 | 264,711,071 | 25.74 |
| Over $3,500 | 170,399,114 | 15.15 | 75,611,080 | 7.35 |
| Total | 1,124,673,172 | 100.00 | 1,028,601,142 | 100.00 |

| Price Group | Two Months 1957 Dollars | Two Months 1957 % of Total | Two Months 1956 Dollars | Two Months 1956 % of Total |
|---|---|---|---|---|
| Under $2,000 | 25,188,269 | 1.27 | 306,631,634 | 15.12 |
| $2,001 to $2,500 | 1,137,398,770 | 51.41 | 1,031,824,102 | 50.87 |
| $2,501 to $3,500 | 701,741,537 | 31.71 | 532,314,533 | 26.25 |
| Over $3,500 | 34,357,089 | 15.61 | 157,325,272 | 7.76 |
| Total | 2,212,685,855 | 100.00 | 2,028,095,541 | 100.00 |

*—Calculated on basis of new car registrations, as reported by R. L. Polk & Co., in conjunction with advertised delivered price at factory of four-door sedan or equivalent model. Does not include transportation charges or extra equipment.

†—New registrations of American made cars only. Does not include imported foreign cars.

## 1957 NEW REGISTRATIONS*

*Arranged by Makes in Descending Order According to the 1957 Two Months' Total*

### NEW PASSENGER CARS

| MAKE | February 1957 | January 1957 | February 1956 | TWO MONTHS 1957 | TWO MONTHS 1956 |
|---|---|---|---|---|---|
| Ford | 108,672 | 110,454 | 93,599 | 219,126 | 179,674 |
| Chevrolet | 104,228 | 101,116 | 114,967 | 205,344 | 224,009 |
| Plymouth | 43,261 | 41,262 | 38,341 | 84,523 | 75,286 |
| Buick | 33,299 | 35,013 | 45,562 | 68,312 | 90,355 |
| Oldsmobile | 30,583 | 31,787 | 35,888 | 62,380 | 72,413 |
| Pontiac | 25,199 | 24,015 | 28,600 | 49,214 | 57,321 |
| Mercury | 20,565 | 19,215 | 20,136 | 39,780 | 39,836 |
| Dodge | 18,352 | 18,442 | 16,107 | 36,794 | 31,638 |
| Cadillac | 10,841 | 11,809 | 10,308 | 22,650 | 21,780 |
| Chrysler | 10,974 | 10,439 | 8,875 | 21,413 | 17,971 |
| De Soto | 8,412 | 8,462 | 7,604 | 16,874 | 15,100 |
| Rambler | 5,058 | 5,210 | 5,213 | 10,268 | 9,839 |
| Studebaker | 4,260 | 5,051 | 7,400 | 9,311 | 14,430 |
| Lincoln | 3,148 | 3,076 | 3,169 | 6,224 | 6,111 |
| Nash | 966 | 1,192 | 2,368 | 2,158 | 4,565 |
| Metropolitan | 572 | 585 | 264 | 1,157 | 577 |
| Hudson | 539 | 512 | 916 | 1,051 | 1,892 |
| Packard | 536 | 383 | 2,733 | 899 | 5,566 |
| Continental | 70 | 67 | 166 | 137 | 375 |
| Misc. Domestic | 237 | 271 | 124 | 508 | 228 |
| Foreign | 8,943 | 8,979 | 8,211 | 17,922 | 16,284 |
| Total—All Makes | 438,725 | 437,320 | 447,542 | 876,045 | 879,190 |

* Based on data from R. L. Polk & Co.

### NEW TRUCKS

| MAKE | February 1957 | January 1957 | February 1956 | TWO MONTHS 1957 | TWO MONTHS 1956 |
|---|---|---|---|---|---|
| Chevrolet | 22,789 | 20,820 | 22,133 | 43,589 | 44,419 |
| Ford | 18,244 | 13,296 | 18,791 | 31,540 | 37,835 |
| International | 6,789 | 7,539 | 7,942 | 14,308 | 15,950 |
| G. M. C. | 5,101 | 5,175 | 6,970 | 10,276 | 13,842 |
| Dodge | 3,320 | 3,881 | 3,863 | 7,201 | 8,003 |
| Willys Truck | 1,293 | 1,367 | 949 | 2,660 | 1,810 |
| White | 997 | 1,015 | 1,330 | 2,012 | 2,551 |
| Mack | 886 | 1,016 | 897 | 1,882 | 1,856 |
| Studebaker | 591 | 697 | 845 | 1,288 | 1,894 |
| Willys Jeep | 509 | 506 | 656 | 1,015 | 1,106 |
| Diamond T | 253 | 308 | 299 | 561 | 607 |
| Reo | 161 | 236 | 191 | 419 | 409 |
| Divco | 204 | 203 | 262 | 407 | 495 |
| Kenworth | 71 | 61 | 66 | 132 | 174 |
| F. W. D. | 52 | 51 | 31 | 103 | 72 |
| Brockway | 37 | 51 | 58 | 88 | 131 |
| Peterbilt | 36 | 45 | 22 | 81 | 60 |
| Misc. Domestic | 48 | 116 | 60 | 164 | 155 |
| Foreign | 788 | 594 | 255 | 1,382 | 480 |
| Total—All Makes | 62,129 | 56,979 | 65,478 | 119,108 | 131,619 |

* Based on data from R. L. Polk & Co.

# New Liquid-Cooled Automotive Brakes

BRAKE failure caused by frictional heat is said to have been overcome by a new liquid-cooled brake just introduced by Raybestos Division of Raybestos-Manhattan, Inc. Preliminary tests indicate that overall efficiency of the liquid-cooled brake will exceed that of current model passenger car brakes by over 300 per cent.

Failure of conventional brakes during a succession of high-speed stops is normally caused either by "fade" with the loss of frictional power of brake lining or by brake pedal "washout" due to heat expansion of drums. The key to the success of the Raybestos brake is the complete elimination of heat build-up, regardless of the frequency of high-speed stops, making it impossible for the brake to fade. Dissipation of heat is accomplished by the channeling of liquid from the engine cooling system through tunnels in copper linings fused to a variation of conventional brake shoes. The copper linings contact conventional brake drums lined with a special Raybestos friction material.

Tests indicate that original linings for the new Raybestos brake will be good for approximately three times the normally expected mileage of conventional brake linings. After 12,500 high-speed "emergency" stops at 90-sec intervals in a dynamometer test run, the new Raybestos liquid-cooled brake continued to function efficiently and showed no signs of overheating, failure or fading. Raybestos engineers state this test is comparable to a succession of sudden stops of a 5000 lb automobile traveling 100 mph with all the energy absorbed by one brake.

*Closeup of Raybestos liquid cooled brake showing drum lined with special friction material and water-cooled shoes with copper linings*

The liquid-cooled brake is so simply designed that two Raybestos brake servicemen install it on a stock passenger car in about three hours.

In addition to its successful use on passenger cars, the Raybestos liquid-cooled brake has many other applications, both as a brake and as a clutch. At the present time, the B. F. Goodrich Aviation Products Division is adapting it for aircraft use. National Supply Co., the manufacturer and distributor of oil field equipment, is making prototypes for use on rotary drilling rigs. Wagner Electric Corp., a leading manufacturer of brakes and brake parts, also is carrying on an active field testing program for various brake applications.

### *1956 Sales of Eaton at High Although Net Declined a Bit*

Sales of Eaton Manufacturing Co. in 1956 reached a new high, but rising costs and lower passenger car production contributed to a small decline in earnings.

Consolidated sales in the year ended Dec. 31, 1956, amounted to $227,196,703, compared with $218,116,159 the year before. Net profits amounted to $12,980,828 compared to $13,285,496 in 1955.

• • •

### *Mack Reports All-Time Highs On Sales, Earnings in 1956*

Earnings of Mack Trucks, Inc., rose 55 per cent in 1956, on a sales gain of 31 per cent. Both sales and earnings established all-time highs in the company's 57-year history.

Net income after taxes for the year reached $12,103,763. This compares with 1955 earnings of $7,815,783.

Consolidated net sales were $254-, 243,784, against $194,317,035 in 1955. Orders on hand at the 1956 year-end totaled more than $94 million, an increase of 61 per cent over the comparable 1955 figure of $58 million.

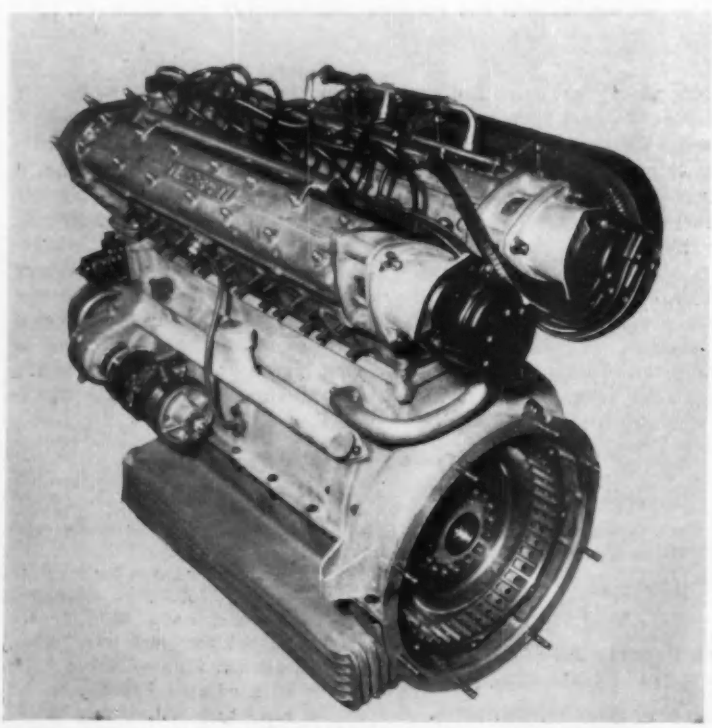
*Mercedes-Benz roadster with new frame, rear suspension, and body*

# ..GENEVA..

# Europe's 1957 Spring Show

BY ROBERT BRAUNSCHWEIG

SINCE the end of World War II, cars from all countries have been available without restrictions in Switzerland. This year the highly competitive character of the Swiss market and the economic importance of the Geneva show were even more apparent than previously. Preparations for next year's world fair in Belgium had made it necessary to cancel the Brussels show; and the Turin show, which normally takes place in April, has been postponed until November. Both the American and the European automobile industry was fully represented. Several new and modified models were shown for the first time, specialist body builders presented numerous new creations, and a very large section of the show was devoted to minicars.



*New 210 cu in. Maserati six cylinder engine has twin ignition and two overhead camshafts*

The Swiss market still is dominated by the Volkswagen, which, however, did not quite reach its sales figure of 1955 during the past year. It is closely followed by the GM-owned Opel. The total number of retail sales increased by 10 per cent from 51,222 passenger cars in 1955 to 56,343 in 1956. German and French cars increased their share considerably, whereas the U. S. percentage has again dropped from 10.6 to nearly 8 per cent of total sales. Although the styling of the new American models was very favorably commented upon, the low ground clearance, the large piston displacement, and the length and width of this year's U. S. cars will not help their sale in a country

*British Frisky minicar which is powered by a 15 cu in. Villiers engine*

*At right is shown the new aircooled two-stroke, two-cylinder Villiers engine developed for the Frisky*

notorious for its narrow, overcrowded and winding main roads and numerous mountains.

A number of new models were shown for the first time. The German Goliath, a member of the Borgward group, took the bold step of switching over from a two-stroke, injection, two-cylinder engine to a horizontally opposed, water-cooled, four-cylinder engine for the front wheel drive model which, with the new engine, is called the 1100. A rigid axle with conventional springs is used for the rear wheels. Front suspension is independent and consists of an upper transverse spring and lower support arms.

Particular attention was attracted by several new sports models of the "Gran Turismo" class. This is the new version of what used to be called production-type sports cars, open and closed two- and two/four passenger cars of higher than average performance, better than average handling, but still suitable for everyday use. An outstanding exhibit in this category was the Mercedes 300 SL, a development of the well-known coupe with gull-wing doors. It is a two-passenger convertible with conventional windows in the doors, a much improved rear suspension and with power output increased to 250 hp (gross) at 6200 rpm. The engine still has the Bosch-type fuel injection system feeding into the combustion chambers. The rear suspension now has a low-pivot, single joint swing axle at the rear as fitted to all passenger and sports cars of the firm, but as an additional improvement a destabilizing coil spring, named a "compensating spring," is fitted between the two swinging half axles to provide a different spring rate for different deflection of the wheels. The windshield is wrapped round to a limited extent, and the conventionally-operated unlined top disappears under a sheet steel tonneau when folded.

With the new 3½ litre Gran Turismo model, Maserati now bids for a place on the international scene which this make has never achieved before. The new model was shown in two different versions, two passenger coupes with rumble seats by both Touring and Allemano. The engine is a slightly enlarged and slightly tuned-down edition of the competition 3-litre power unit, but a torque of 253 lb ft (net) at 3500 rpm is claimed. The Touring body has a panoramic windshield with very slender side posts and a very wide door. The second body type by Allemano was styled by Michelotti, a young and upcoming Italian designer who was responsible also for all the bodies shown by Ghia-Aigle, Vignale, Allemano, a new Lancia convertible and, finally, the British minicar prototype shown under the name of Frisky.

Returning to the Maserati, it is interesting to note that a German ZF four speed, all-synchromesh transmission, Jaguar rear axle

*Aston Martin DB 2-4 Mark III is designed for the export market*

components and British-made shock absorbers are used in this vehicle. The frame is a tubular structure, a design in which Italian proprietary firms excel.

Ferrari showed a new roadster on its most conventional model, the 250 Gran Turismo. Its body is by Pinin Farina and can be considered as an open replica of the "Super Fast" coupe shown at the Paris exhibition in 1956. This is a forerunner of a new body type which is tentatively scheduled for the American market. The shallow front opening has a forward inclination towards the upper edge and is matched by a slim horizontal slit on the hood for intake air.

A much modified Gran Turismo 3-litre from Great Britain is the Aston Martin DB 2-4 Mark III with left-hand drive. This export-only model has an engine developing 200 hp (gross) at 5000 rpm, with twin exhaust system, numerous detail improvements and optional Girling disk brakes for the front wheels.

The new Jaguar 3.4 litre was shown publicly for the first time on the continent. This is the conventional 2.4 litre sedan with a slightly wider front grille, twin exhaust and, of course, the larger engine in its more powerful, 210 hp version. The manually operated four-speed transmission, with or without the Laycock-de Normanville overdrive unit, is supplied. A Borg Warner automatic transmission with direct drive coupling also is available.


*Pinin Farina body on Ferrari 250 GT chassis*

Other new British exhibits included the entirely new Vauxhall Victor and the modified Austin A55 which now resembles the larger six cylinder models in its styling.

With the Suez crisis still fresh in the memory even in the unrestricted market of Switzerland, the ultra-small car movement seems to have gathered even more impetus. The German minicars already have cut deep into several markets, and the new Goggomobile coupe shows that even a diminutive motor vehicle can be made quite good looking. A newcomer in this field is the Phoenix Frisky, of which the first prototype was shown in Geneva. The car has a most unusual look with a panoramic windshield, deep gull-wing type doors and tiny wheels. Interior width is uncommonly good, but the Villiers two stroke engine takes up most of the space behind the seats.

The "Spiagetta" or beach car on the Fiat 600 Multipla chassis was designed by Michelotti. A surprising number of passengers can be carried, three seats being provided on the front bench which runs around the sides and the rear end. The sides are very low, so that no door is required.

Another notable creation designed by Michelotti is a small Lotus roadster on the tubular frame Mk.11 sports chassis. This is the first example of a car of that make with body lines conforming to present styling concepts, the original competition roadsters of the firm showing stark and purely functional outlines.

Minimum aerodynamic resistance is the main feature of two single passenger competition coupes on the Pinin Farina stand, which were built by this famous coachbuilder and by Carol Abarth. The two sister vehicles have tuned Fiat 600 and Alfa Romeo 1290 cc engines, respectively, mounted behind the driver, but in front of the rear axle. The Fiat engine is enlarged to 750 cc with Abarth's own conversion sets, and very high power outputs are claimed

(*Turn to page* 109, *please*)

*Austin A55 Cambridge, successor to the A50*

# PRODUCTION *Chief Topic*

By Thomas Mac New

## *at* SAE *Aeronautic Meeting*

THE big emphasis was on production at the SAE National Aeronautic Meeting and Engineering Display held in New York last month. A top production executive stated that the airframe industry has turned from the lathe to basically a profiling business. Actually, it has gone much further than that with the inception of tape controlled and automatic processing equipment.

Production engineers hit hard at such subjects as chemical milling, electrical discharge machining, ultrasonics, and numerical control. More teamwork was a cry heard at many of the panel discussions. With the new materials and production equipment coming more into evidence, there has to be a meeting of minds between all phases of aircraft production and design. Stress was placed on preplanning and getting together a project team for new designs in order to keep costs down.

Engineers talked more about their problems than about the solutions to them! All wanted shorter lead time. How to do it? Some answers dwelled on numerical control. But, in order to have numerical control, first there has to be data reduction and simplified drawings prepared. These are not easy steps.

Most of the engineers believe that future aircraft will become larger, but machines needed to build them will remain about the same size. Plants today are sufficient except that production people would like more height to accommodate today's and future craft.

Roughing operations have to go if costs are to be kept down. They want to use a raw component and start finishing operations immediately instead of going through a complete conventional production cycle. It was during this part of the program that electrical discharge machining, chemical milling, and ultrasonics were widely discussed.

Naturally, in order to carry out such a program, money must be spent for manufacturing research and development. These engineers want to stay away from departmentalization and want a clear channel of communications from the design level to the production floor. One of their big complaints is that machine tool companies won't gamble on new designs —they wait for the aircraft producers' commitment before starting a radical machine design.

It was rather noteworthy that a new pattern is being started on managements' dealings with engineering personnel. The concept is to treat engineers as individuals rather than a group. Take them out of vast open spaces with hundreds of drawing boards and put them where they can do some thinking as well as working. Management has found that individual performance goes up as soon as the man leaves the area known as "the bull pen."

During the course of the four-day meeting, several high awards were made to deserving recipients. The Daniel S. Guggenheim Award was presented posthumously to Frederick B. Rentschler. He was chairman and chief executive officer of United Aircraft Corp. C. H. Zimmerman, head of the Dynamics Stability Branch and assistant chief, Stability Research Division, Langley Aeronautical Laboratory, NACA, received the Wright Brothers Award. The award was given for Mr. Zimmerman's paper "Some General Considerations Concerning VTOL Aircraft" which was presented at the 1956 meeting.

A great many technical papers were read at the sessions. Extracts of some are presented herewith:

## MOLYBDENUM

### *for Aircraft Applications*

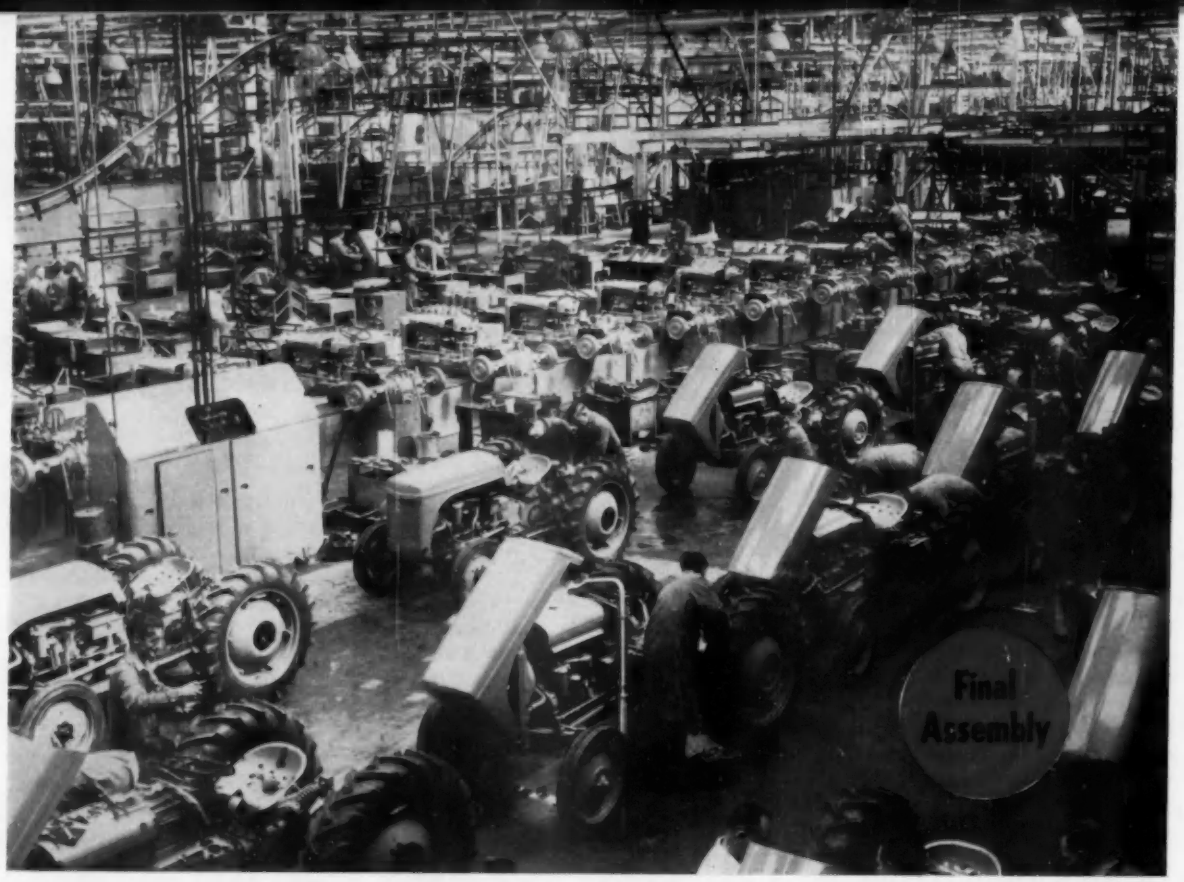
By R. T. Begley

**Aviation Gas Turbine Div.**
**WESTINGHOUSE ELECTRIC CORP.**

THE real potential of molybdenum lies in engines which are specifically designed to fully exploit the advantages of molybdenum's unique high temperature properties and which allow in so far as possible, for some of its disadvantages.

It appears that we have only begun to realize the high temperature properties attainable with molybdenum-base alloys, since the alloys currently available contain only about one per cent alloy addition. Work is now in progress on molybdenum-base alloys which will retain their high strength at temperatures considerably in excess of 2000 F. Although the outlook for developing higher strength alloys is quite encouraging, the problem of providing adequate oxidation resistance for 100 hr at temperatures in the range of 2500-2600 F is indeed serious. The

(*Turn to page* 126, *please*)




*Final assembly of the Ferguson 35 tractor. Engine and rear axle assembly, rolled up on adjustable dollies, are initially mated to the transmission unit fixed on the main conveyor. After painting, a second conveyor carries the tractors end-on while sheet metal pressings, wheels, and other items are added.*

# Advanced Tooling for the British-Built Ferguson Tractor

THE retooling and modernization just completed at Standard Motor Co.'s plants producing Ferguson tractors in England make it the largest tractor manufacturer in Europe. Current capacity is 100,000 units a year—some 500 a day including spare parts equivalents — and an eventual 125,000 is planned. This is done with two shifts working an 85-hour week.

The £4.5 ($12.5) million expansion program was aimed at achieving 30 per cent greater production from the existing floor area, and at changing over to the new tractor with minimum interruption of output of the old one. The Ferguson 35, introduced last October, is very similar to the American model except for the engine. Optional power units include a 138-cu in. Diesel and 134-cu in. engines for gasoline, vaporizing oil and lamp oil. The entire tractor is built by Standard under contract to Massey-Harris-Ferguson.

The changeover was effected in less than two weeks, despite the fact that the new model has only seven parts in common with the smaller one it replaced. Plant layout was entirely altered, and aside from relocating 1400 machine tools, 220 new ones were installed as well as 22 additional automatic transfer lines.

Because of the inability of the British machine tool industry to supply the necessary equipment, a quarter of the new machines was purchased in Germany. This proportion is even higher in the case of transfer lines, and, of the total of 33 now in use, 16 are German and the rest British. Planning engineers reported that American machines were ruled out not only on account of the dollar shortage, but also because British and Ger-

By David Scott

## Transmission Housing

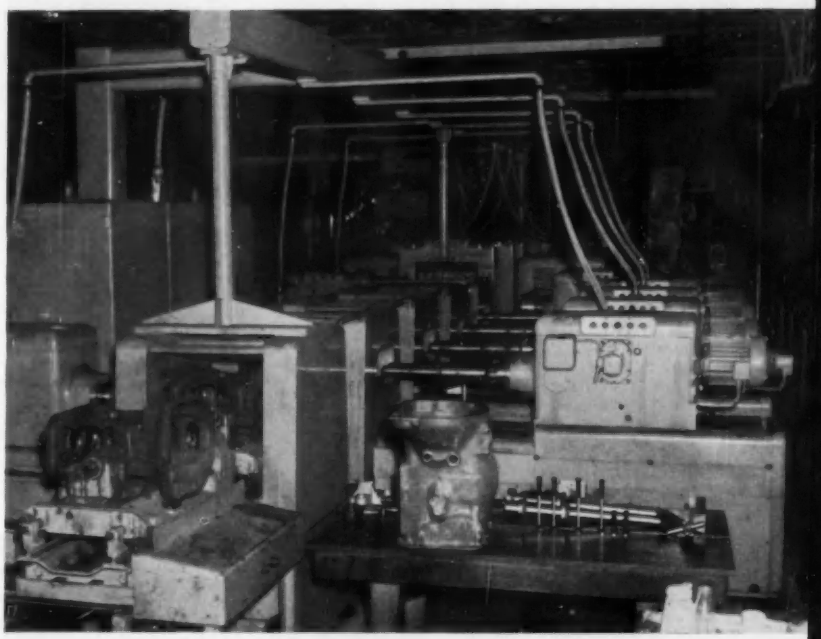
man prices were often less than half as much.

Chassis production is concentrated at the Banner Lane factory near Coventry. Machining of the transmission housing is an example of the automated setups. The two end faces of the casting are rough- and finish - milled at the first four stations of a Heller eight-station transfer line. At the remaining four stations the two holes in the three walls for the main and countershaft bearings are rough and finish bore. Long triple-tipped tools operating from one side are used. But at the final station there is an additional boring head on the other side that finish-machines the two end holes to close limits. This avoids inaccuracy caused by whip at the end of the long tools. To insure exact hole positioning, housings are only loosely carried on platens, then raised, located and clamped at each station.

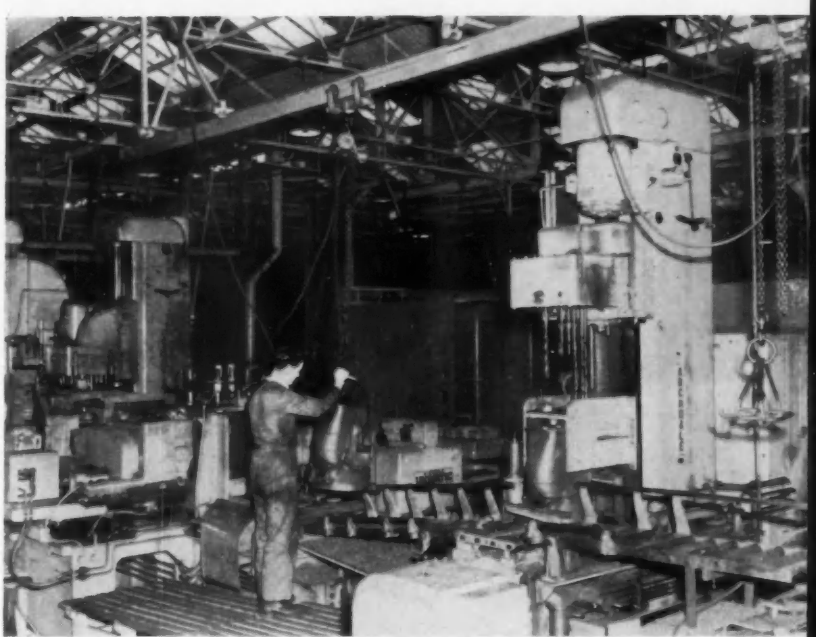
Work leaving this line is carried on a return loop back to the load-unload station, where the single operator removes the castings from the platens and passes them on by gravity roller conveyor to the next transfer line. This as a four-station Heller which mills the top and bottom faces, and rough- and finish-mills two faces deep inside the casing for the reverse gear. A 10-station Archdale machine then drills and taps the end, top and bottom faces. Castings located on the clutch faces on platens are manually unloaded at the end of this line, and placed on a short section of inclined track.

Each housing rolls a few feet onto a shuttle section of track that carries it tranversely into an adjacent Archdale seven-spindle vertical drill. Here work is clamped upwards by a hydraulic ram rising from below, and located on the finished internal bores. This insures accurate alignment for reaming the gear selector rod holes, reverse gear bore, and locating dowel holes.

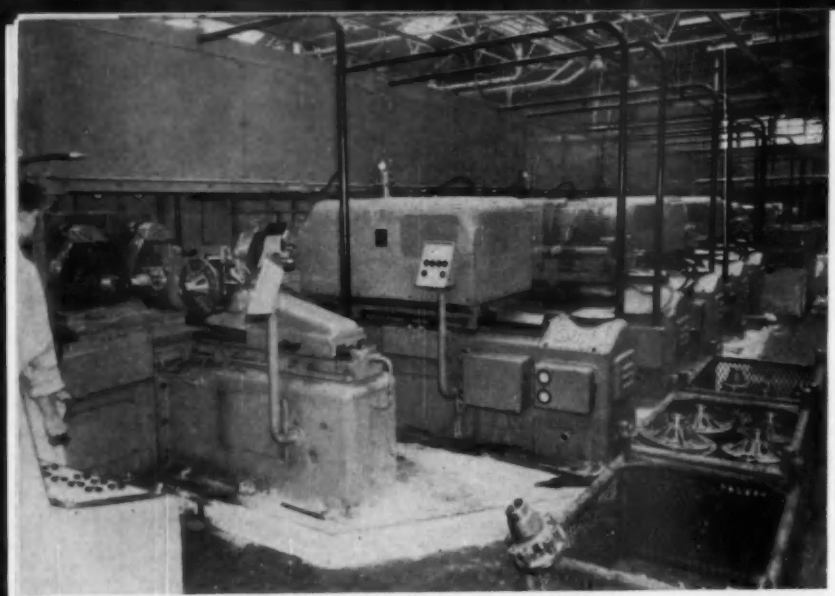
When this automatic cycle is completed, the casting is shuttled back to the main roller track where it slides down to the head of the final line. There an operator in-

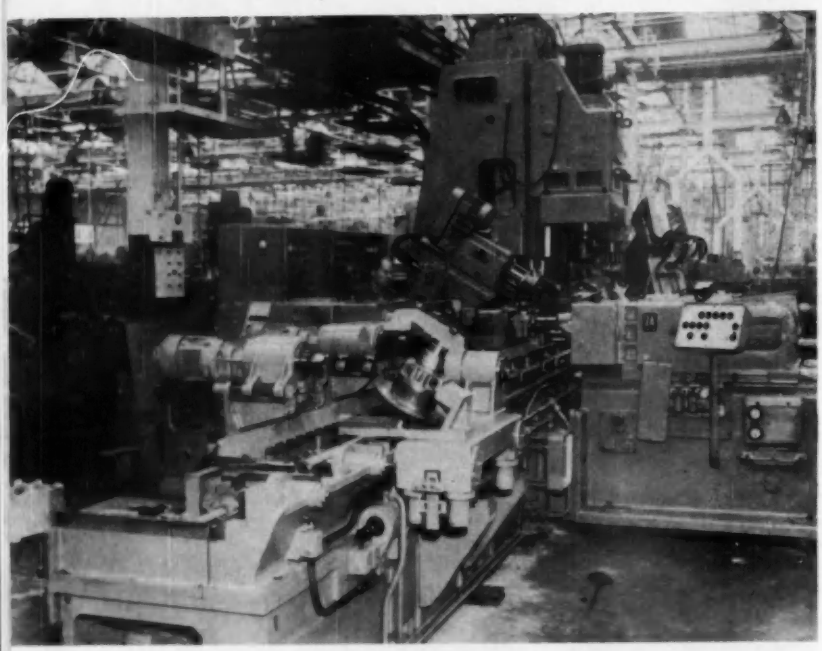


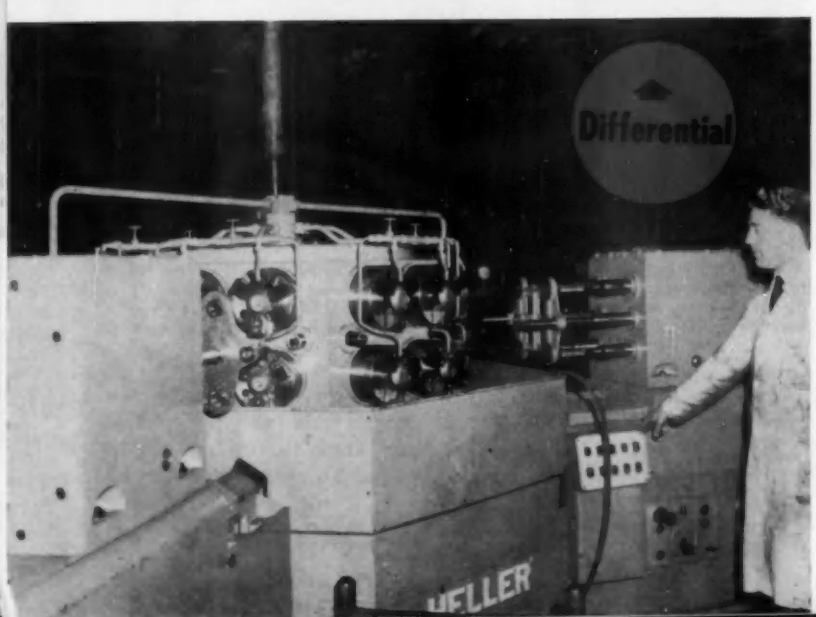
*Internal walls of the transmission housing are rough and finish bored with triple-tipped tools at the last four stations of this Heller eight-station transfer line. The single boring head at the extreme left finish-machines the two end holes to avoid inaccuracy resulting from whip at the ends of the long tools.*



*Archdale multi-spindle drill between two transfer lines reams seven holes in the transmission housing. Automatic loading and unloading are done by a shuttling section of the inclined roller track, and the casting is located on its finished internal bores by a hydraulic ram rising from below.*








verts it with a power hoist and loads it into the Archdale 10-stasion machine that drills and taps the clutch facing.

The two halves of the differential case are simultaneously machined on an unusual 14-station line built by Huller. Because of external variations in the rough casting, the work is centered internally on its main bores. To do this, it is pre-loaded on a pair of horizontal bars carried on the swiveling head of the loading slide. The head is then swung 90 deg to face the line, and the slide travels forward to insert the work into the waiting platens.

Castings are gripped externally by self-aligning vertical chucks that are mechanically closed by an electric motor carried on a slide back of them. It drives through a pair of slipping clutches and shafts with slot-engagement of the clamping mechanisms. After the chucks are locked, motor and loading slides retract and the double platen is transferred forward to the first work station.

Operations on the large piece include facing, boring, turning, drilling, counter-boring and tapping. The eccentric oil channel on the thrust face is cut, as is the spherical bore that accommodates the differential pinions. The collar, ex-

***The 14-station Huller line machines pairs on differential case halves. Work is located by internal bores by the loading slide (seen here with swivelling head angled towards the operator), then inserted in the two self-centering external chucks on the waiting platen. The electro-mechanical unit that closes the chucks retracts before the platen moves to the first work station.***

***MIDDLE—***

***Assembled differential cases are machined on this Huller seven-station line. Each workpiece is loaded twice in different positions for the complete cycle (returned to the head of the line by return conveyor), and one is completed every 75 sec. This machine was photographed during installation by German technicians.***

***BOTTOM—***

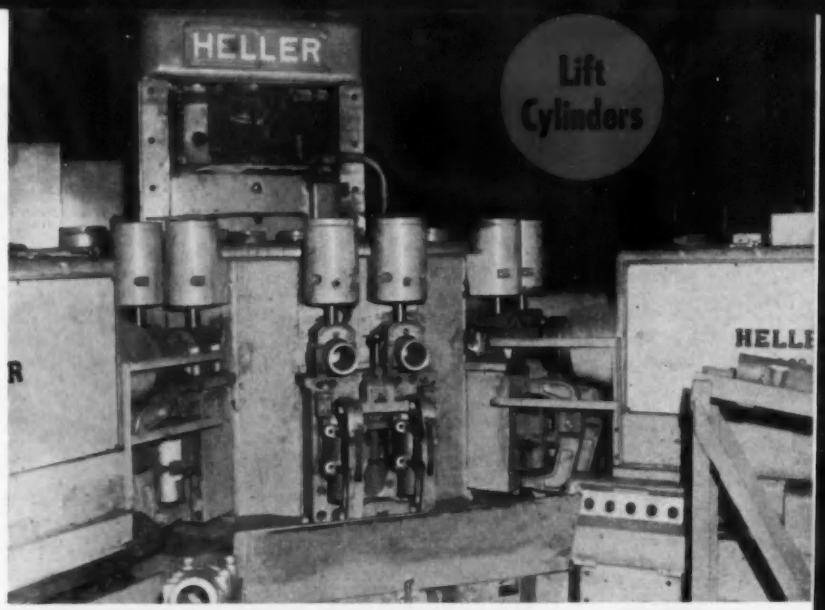
***Heller 5-station rotary machines a set of four differential pinion blanks in an 80-sec cycle. Work is chucked hydraulically, and multi-spindle tooling drills, reams and faces.***

tending through the chuck, is machined on the other side to take the taper roller bearing. Similar operations are carried out on the smaller piece, which internally is an exact matching half.

Total cycle time is 150 sec, and after completion the work and platens are returned to the head of the line by an enclosed overhead track. Since tractor production is keyed to a 100-sec cycle, two identical transfer lines are in use to meet this output and provide for future increases.

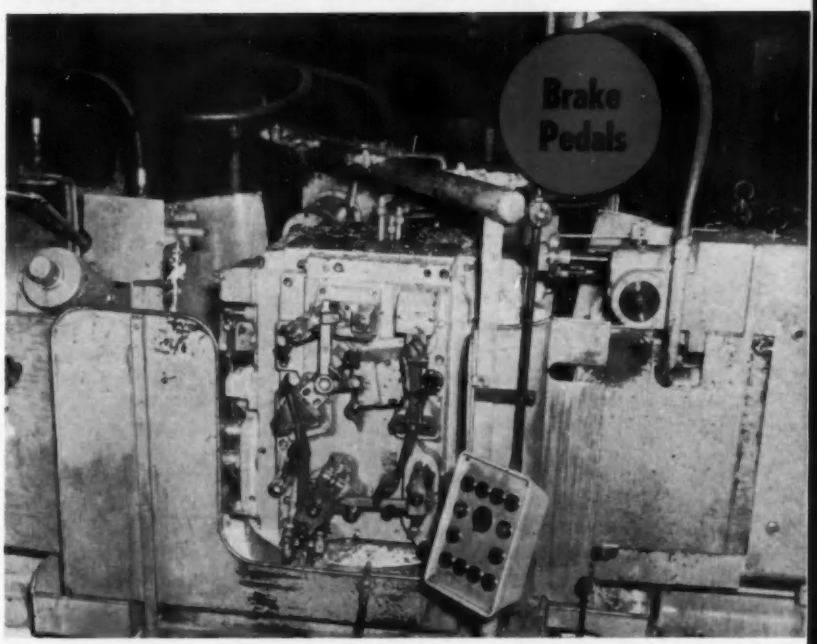
An adjacent Huller line machines the assembled differential casing on four double and five single stations. Two components are machined at each station at different loading positions. allowing one finished case to be unloaded after each cycle of 75 sec. At the first load, two opposing cross pin holes are drilled, core drilled, bored and reamed; two angular holes are drilled; and eight holes are spotfaced and chamfered. Then the component is inverted, indexed through 90 deg, and located from two finished cross pin holes. Two opposing cross pin holes are drilled, core drilled, bored and reamed, and one angular hole is drilled.

Hydraulic lift covers are fully machined on a flow-line setup combining two multi-station machine



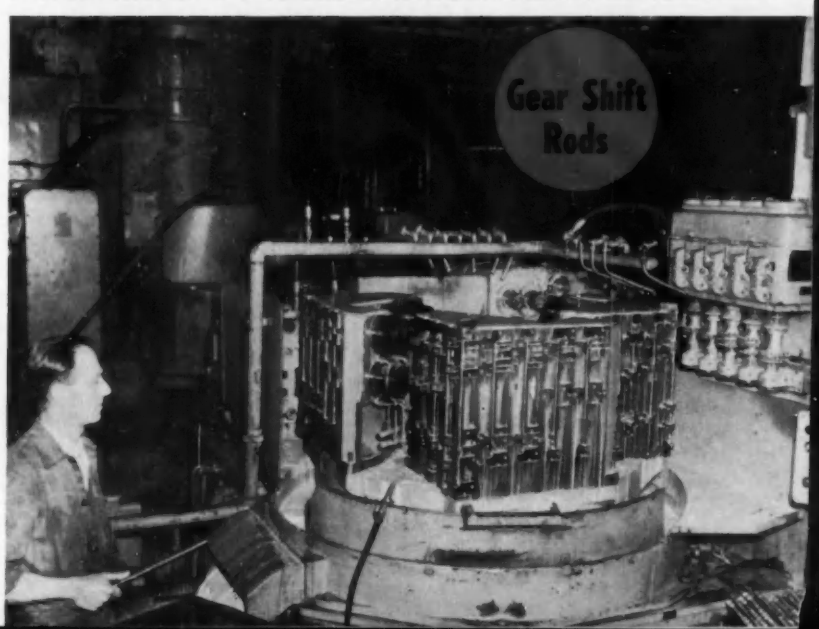

—TOP

***Hydraulic lift cylinders are machined in two loadings on this Heller five-station rotary. A pair of finished units comes off every 200 sec. Work includes milling and drilling the mounting faces, and boring the 8-in. long cylinder.***



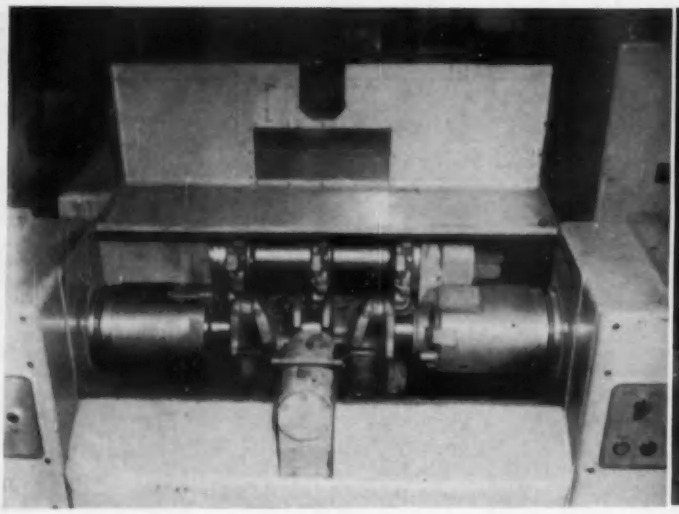

—MIDDLE

***Two pairs of brake pedals are machined with double loading on this Huller four-way rotary. One set is repositioned after each revolution of the square table, and a new one located in the vacated fixtures.***

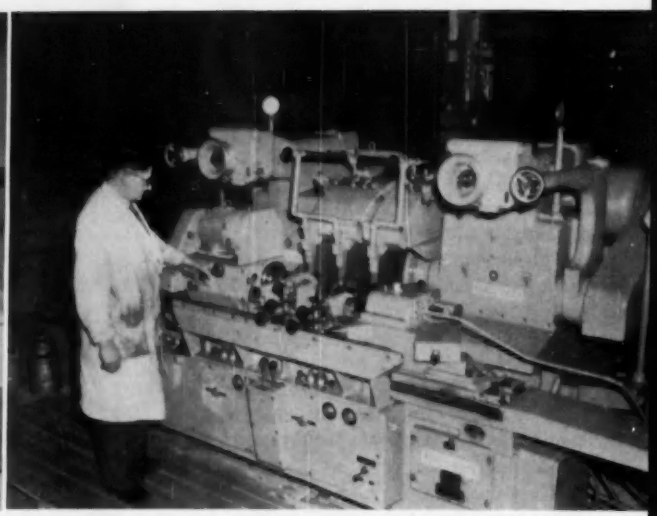



—BOTTOM

***Three-station Huller notches gear shift selector rods on right-angled fixtures each holding nine rods of three different lengths. Setup is for double and triple-loading, with all bars circulating twice and two sizes three times.***



*Heller crankshaft miller machines main bearings in one rotation of the steel forging. The three profile cutters rough the diameters and webs of the Diesel crank.*



*Naxos-Union plunge grinder for Diesel crankshaft main bearings has three wheels on two independent slides. Profiles of the 36-in. diameter wheels are automatically dressed after a preselected number of workpieces.*

Diesel Crankshaft

tools and a transfer line. Mounting faces of the castings are first rough-and finish-milled on a Heller two-way miller. Work is hydraulically clamped on the four - sided rotary table. After each indexing, the retracted cutter - spindles extend forward and the milling slides transverse across the work.

Unloaded covers go to the nearby Archdale six-station vertical rotary that drills all holes in the joint face, and mills, bores and taps the shock spring seating. They then roll down a long gravity conveyor past the entire transfer line to the load-unload station at its far end. There the work is placed face-down on pallets that are conveyed back to the start of the line under the branch beds along one side. This 11-station Archdale Unimatic bores, mills, drills, taps and faces the upper side of the casting.

For the combined engine mounting bracket and front axle support —a complex casting in malleable iron—there is an Archdale line with 13 stations, most of them double-sided. The first two stations are tooled for milling with five-cutter heads on traversing slides on each side. Later, where awkwardly placed holes are drilled and tapped, the heads tilt back to clear the work during transfer. This makes it unnecessary to reposition the work on the pallet. The single operator stands at the end of the line, where pallets are loaded and conveyed to the start on a parallel track.

A great number of rotary-indexing machines are in use. A pair of five-station Heller units machine the forged steel blanks for the differential pinions — work usually done on chucking automatics. Each handles four pieces at once, and runs on an 80-sec cycle to provide a complete set for one tractor.

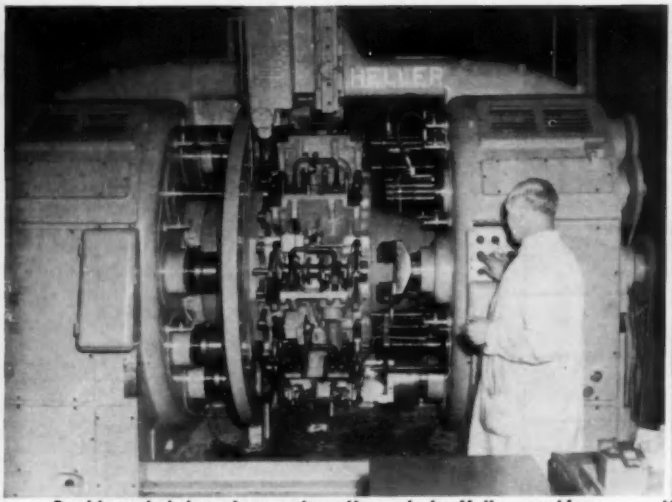
The first of these grips the work externally in stationary hydraulic chucks on the six-sided table. Operations performed at the multi-spindle stations cover center drilling, facing, through drilling, reaming and final reaming.

On the second machine, blanks are carried by their finished holes on internal chucks. A cross-shaped external loading fixture locates a set of them by their bores while the self-centering chucks expand. Here the sequence is rough taper-turn gear face; rough-turn spherical face; turn outside diameter, form radius and chamfer bore; finish taper-turn gear face; and finish-turn spherical radius. Gears are produced on Gleason cutters.

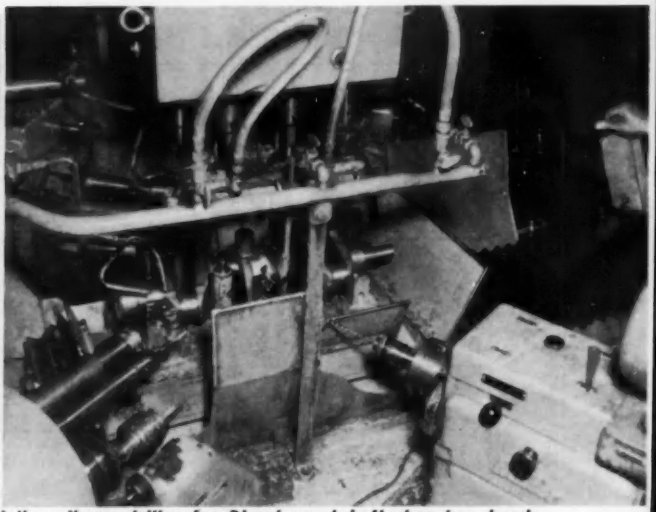
Another Heller rotary machines the hydraulic lift cylinders on a hexagonal table with four fixtures on each face. There are five double stations with tooling for two sets of operations at each, and workpieces go round twice with repositioning after the first revolution.

Castings positioned vertically in the lower fixtures are first milled and drilled on their mounting faces. At the second loading the horizontally-clamped cylinders are bored and recessed. The 2.5-in. bore is 8 in. long, and the recess at the bottom for piston clearance is 0.25 in. wide and 0.06 in. deep. Cycle time for one unit is 100 sec.

Versatile tooling with double cycling is also featured on a Huller four-way machine for break pedals. Each vertical face of the square table has fixtures for two pairs of left- and right-hand pedals. One set comes off after every complete revolution, and the other is repositioned facing the other way in the vacated fixture. A new set is loaded at the same time. Location is mechanical and clamping hydraulic. Operations during the two loadings include drilling the main bores and spotfacing both sides; milling the pinch-bolt slits, bolt facings and stop pads; and drilling the link-pin and oil holes.




*Double-ended drum-type automatic made by Heller machines Diesel crankshaft ends in 10 stations. Front operations cover turning, drilling, tapping and keyway milling, while the rear flange is turned, drilled and tapped.*



*Huller oilway driller for Diesel crankshafts has two heads with indexing turrets (extreme left) that drill, bore, tap and chamfer. After the automatic cycle is completed, hydraulic work clamping releases as the fixture moves to the load-unload position at right on its bellows-covered slide.*

Gear shift selector rods are notched on a rotary indexing machine also built by Huller. Three different-length bars (14-, 15- and 18-in.) are handled, and the table has three vertical right - angled work holders, each with two loading faces and fixtures for nine bars. All bars circulate twice, and two of the sizes three times when different planes must be presented. Each bar is relocated (or unloaded) after every table revolution.

At the first work station bars are notched by form milling cutters on five vertical spindles carried on a cross slide. Flats are milled at the second station by a cross-traversing head with seven horizontal spindles. Finally, taper holes are drilled by a four-spindle head that in-feeds at the third station.

Previously, bar stock for these selector rods is prepared on a Farmer Norton bar turning machine. The 12½-ft lengths of 11/16 in. diameter are finished to ⅝-in. diameter with a feed of 6 fpm. Loading and unloading of this setup is automatic, with gravity rails dropping bars singly onto the feeding drive, and extracting arms raising the finished ones to the second set of rails. From there bars roll into place for automatic feeding into a B. S. A. cut-off machine. One operator handles the entire selector rod sequence.

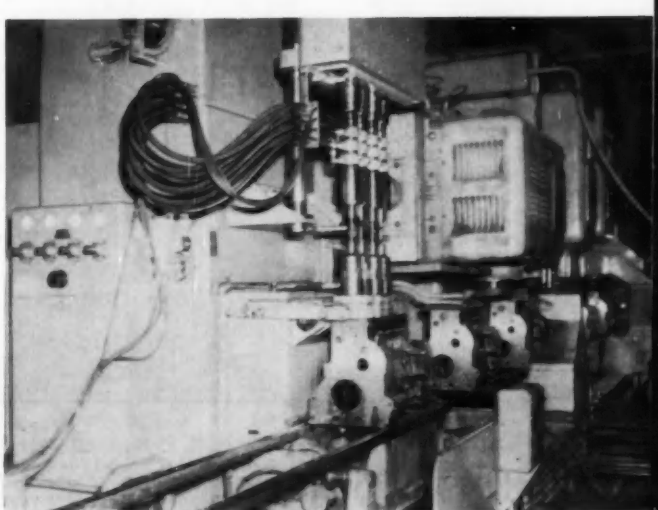
Engine production is at Standard's Canley factory a few miles away. The crankshaft line, tooled largely with the latest German machines, is of special interest. After center drilling for location, the steel forgings have the main bearings rough-milled on a new Heller unit. The milling slide with horizontal spindle has three profile cutters that machine both the bearings and adjacent webs during one revolution.

These bearings are then plunge-ground on a Naxos-Union machine with three 36-in. wheels on two independently operated spindle heads. It incorporates an automatic trueing device that functions after completion of a predetermined number of workpieces. When the wheels are fully retracted, a pair of diamonds carried on slides below the work trace the cutting

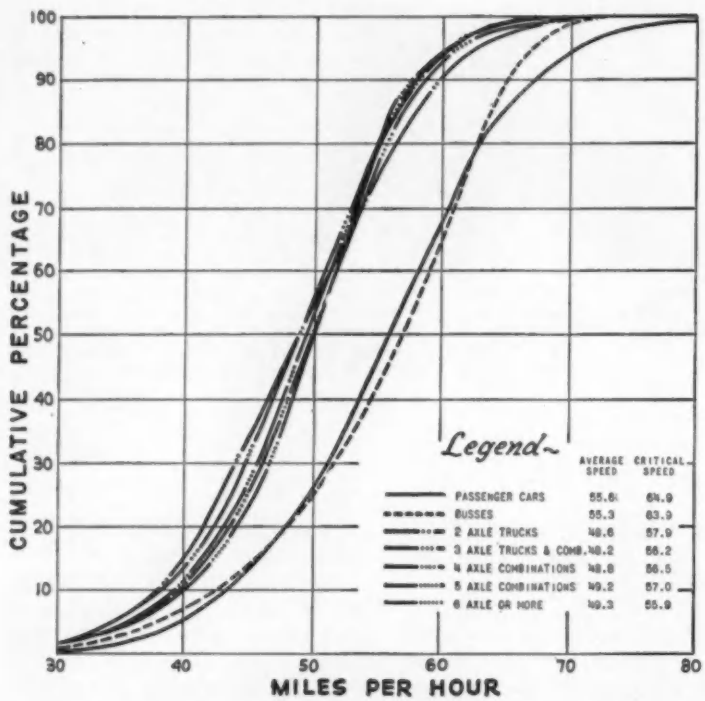
(*Turn to page* 116, *please*)

*Main bores are honed at the last station of the Diesel engine cylinder block line. Tools of this Gehring unit are guided by sleeve extensions on the clamping plate. Sizing is automatic, and the hones retract when limits are reached.*

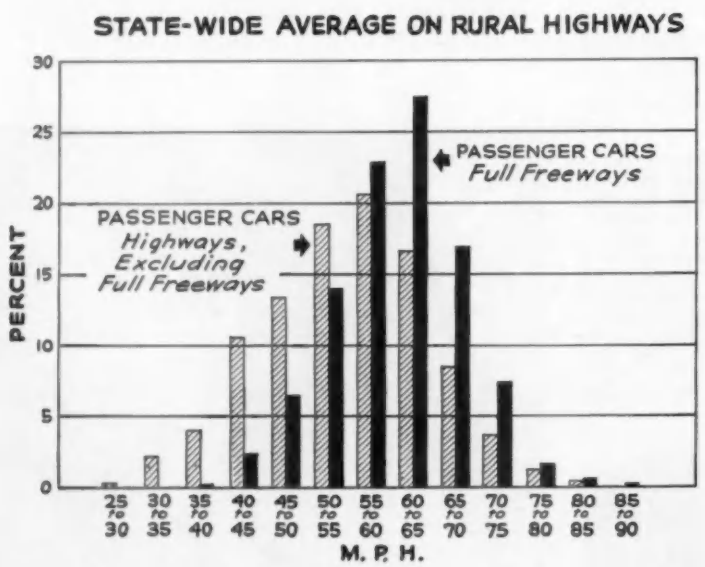
**Cylinder Block**



# Higher Speeds on Modern Highways




*The speeds of vehicles by type, as found in the October, 1956, survey, are represented by the curves in the above drawing. Note that the speeds of passenger cars and buses are quite similar, while the curves for the various types of trucks fall into a lower speed group.*




*The survey showed that passenger cars generally travel faster on rural freeways than on other types of rural highways.*

**State-wide Survey in California Discloses Significant Data on Car, Truck and Bus Traffic**

**By George M. Webb**
Traffic Engineer
CALIFORNIA DIVISION OF HIGHWAYS

VEHICULAR speeds are a vital factor which must be taken into consideration in the development and establishment of modern highway design standards. (Also, future vehicle design.—Ed.) Consequently, in the interests of ever-improving highway operation, the Traffic Department of the Division of Highways periodically conducts a state-wide speed survey on state highways, the latest of which was undertaken during the month of October, 1956.

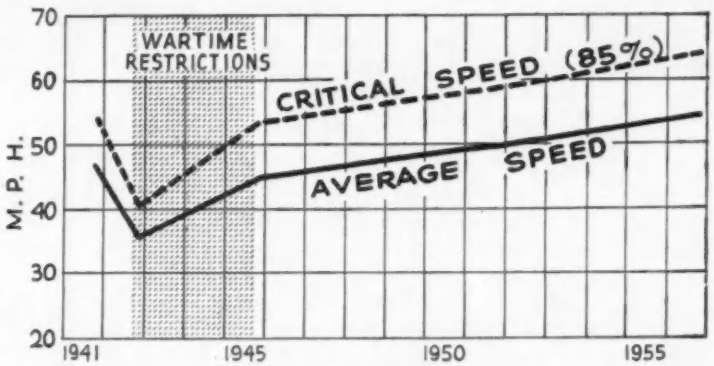
The data obtained during this recent study are shown on the accompanying charts, which represent the results of 35,439 individual observations of vehicular speeds under free-flowing traffic conditions. The speed checks were made during off-peak hours at selected rural locations on straight alignment in areas out of the influence of speed zones, roadside business, and other physical controls which might affect the speed of traffic.

A total of 108 observation stations was used. These may be classified according to roadway type, as follows:

| Number of stations | Type of roadway |
|---|---|
| 47 | 2 Lanes |
| 1 | 3 Lanes |
| 2 | 4 Lanes undivided |
| 5 | 4 Lanes divided |
| 27 | 4 Lanes divided expressway |
| 15 | 4 Lanes divided freeway |
| 1 | 6 Lanes undivided |
| 5 | 6 Lanes divided freeway |
| 5 | 8 Lanes divided freeway |

## Speed Has Increased

It may be interesting to note that the 1956 survey showed that the average speeds of all vehicles were 4.3 mph greater than those observed in 1951. The critical speeds during this period increased by 5.2 mph. (The critical speed is defined as the speed at or below which 85 percent of the traffic is moving.) It might also be noted that the rate of increase per year compares quite closely with the rates of increase found on the previous surveys of 1945, 1948, and 1951.




*Since the end of the World War II restrictions there has been a gradual increase in vehicular speeds. This is illustrated in the above chart of average and critical speeds of all vehicles by years.*

## Truck and Bus Speeds

A comparison of curves on chart at top of page 66 reveals that speeds of the various types of trucks are grouped rather closely and fall approximately seven mph below those of passenger cars in the higher ranges. However, it may be seen that there is very little difference between the speeds of passenger cars and those of buses in the range below 60 mph. It was also found that the average speed of both buses and trucks had increased approximately three mph since 1951.

The speeds of passenger cars, as may be expected, were found to average higher on rural freeways than on other types of rural highways. However, the differences were not as high as some might have imagined. The survey showed that passenger cars average 60.5 mph on rural freeways, as compared to an average speed of 54.7 mph for all other rural locations. Comparable critical speeds were 68.5 and 64.7 mph, respectively.

# Four Colors Sprayed at Once on Dials for Speedometers

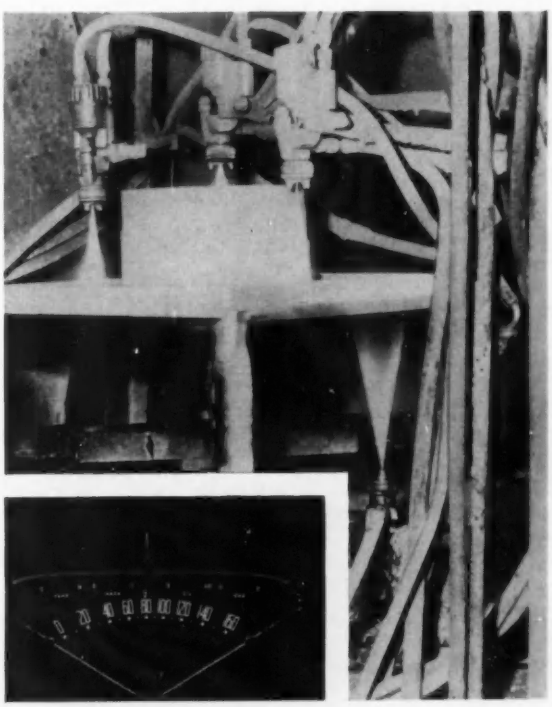
SPECIAL equipment in the painting department has resulted in a labor saving of over 75 percent for G. Felsenthal and Sons, Inc., plastics fabricating and injection molding firm.

In this case, the operation consists of spraying four colors at once on as many as four automobile speedometer or clock dials. Previously, each color was sprayed individually in a separate operation. The operator held a mask against a piece with one hand and sprayed the part with a gun in the other hand. Other operators repeated the process, using different masks to apply different colors.

Now, a turntable, four spray nozzles and a single mask enable one operator to spray four dials with four colors, all at the same time. Four unpainted dials are placed on the turntable. A hand lever raises the turntable and dials up against the mask. A foot pedal rotates the turntable and masks while four nozzles spray the paint. Painted pieces are lifted off the turntable and placed on a conveyor for transfer.

Masks, turntable and nozzles are designed to direct the right color to the right opening in the mask. The nozzles are set at varying distances from the center of the turntable to prevent mixing colors.

With different masks and holders, readjustment of the nozzles and a change in paints, the machine can be used for many different dials.



*Four spray nozzles, a turntable and a multiple mask enable the spraying of four colors on one part at once. Inset: 1957 Chevrolet truck speedometer dial which requires four colors.*

**Possible Applications of Red Metal and Its Alloys in 1957 Passenger Cars Reach a total of 87.57 Lb**

# Copper, Brass and Bronze

COPPER and its alloys—brass and bronze—are more than holding their own as important structural materials in passenger cars, trucks, buses, and tractors. It is conservatively estimated that in 1956 over 200,000 tons of the red metal, including its alloyed forms, found their way into the automotive industries. This year should see an even greater usage of copper and its alloys in body parts, accessories, fuel systems, engines, cooling systems, transmissions, running gear, and electrical systems.

According to figures compiled by AUTOMOTIVE INDUSTRIES and shown in the accompanying table, 1957 passenger cars have a total potential usage of 87.57 lb of copper and its alloys per unit. This figure includes standard and optional parts, such as air conditioning, which alone accounts for 30 lb.

Other data indicate that the 5.8 million automobiles turned out in 1956 used an average of 45 to 50 lb of copper and its alloys per car. This composite figure makes only a moderate allowance for such components and accessories as automatic transmissions, power steering, radios, heaters, air conditioning, power seats, and power windows, where the weight of copper and its alloys is a preponderant factor.

**COPPER PRODUCTS**
*Usable in 1957 Cars**

| COMPOSITE WEIGHT (LB) | |
|---|---|
| Accessories | 38.69 |
| Body Parts | 1.17 |
| Cooling System | 18.73 |
| Electrical System | 19.60 |
| Engine | 1.17 |
| Fuel System | 2.23 |
| Running Gear | 1.78 |
| Transmission | 4.20 |
| Total | 87.57 |

*Estimated by AUTOMOTIVE INDUSTRIES

Coupled with a steadily increasing demand for optional equipment on the part of car buyers is a growing trend toward standardization from year to year of equipment which was formerly a matter of choice. Therefore, it seems quite probable that the total average weight of copper and its alloys in 1957 cars, including optional equipment, will be in the neighborhood of 50 lb.

Reports from the automobile factories support this contention. The 1957 Buick Roadmaster, for example, has more than 100 parts utilizing copper and its alloys with an average weight of 53.7 lb. This year's Chrysler Corp. products are utilizing an average of 42 to 45 lb per unit; a 1957 Plymouth four-door Belvedere sedan incorporates about 175 different parts made from copper or its alloys.

Oldsmobile averages 33 lb in 50 parts; Ford, 32 lb in 38 parts; Willys, 42 lb; Lincoln, 38.6 lb; Cadillac, 48 lb; Continental, 69 lb; Chevrolet, 40 lb; Mercury, 35 lb; and American Motors, 42 lb. Remember that these averages, based on factory reports, are on the ultra-conservative side as far as the inclusion of accessories and optional equipment is concerned. Add power brakes, power steering, power windows, or air conditioning, as many car buyers are doing every day, and totals are seen to rise appreciably.

Despite the fact that 1957 automobile sales to date have been lagging somewhat behind the expected pace, many industry leaders cling steadfast to earlier predictions that this will be a 6.5-million-car year. If so, figuring a modest usage of 48 lb per car, the demand for copper products will surpass the 300-million lb mark in 1957.

Many responsible authorities feel that the explosive U. S. population growth and soaring gross national product portend an annual automobile production rate of 10 million units with the next 10 to 15 years. When this mammoth volume becomes a reality, requirements for copper products will soar to the 500 million lb plus level for passenger cars alone.

Commercial vehicles likewise have an enormous appetite for copper and its alloys. Looking at the year 1956, factory sales of trucks in the up to 14,000 GVW range, which use many passenger car components, totaled about 688,000 units. It is reasonable to estimate that trucks in this weight category used an average of 53 lb of copper and its alloys for a grand total of some 37 million lb.

Factory sales of trucks in the up to 26,000 lb GVW range in 1956 amounted to approximately 331,000 units. If we estimate that vehicles in this weight range used about 56 lb of copper and its alloys per unit, a grand total of about 19 million lb is indicated. The 81,000 or so trucks sold in the over 26,000 GVW range with an estimated usage of 58 lb of copper and its alloys per unit add another 500,000 lb to the total.

In summary, the some 1.1 million trucks sold last year used an estimated average of 56 lb of copper and its alloys per unit for an overall total of about 60 million lb. According to informed industry sources, truck sales should again hit the one-million mark in 1957 with a similarly high demand for copper products. If, as is to be expected under the impetus of such powerful forces as roadbuilding construction, truck sales volume (particularly in the heavy-duty ranges) continues to grow at a steady pace in the years ahead, requirements for copper, brass, and bronze will reach astronomical figures.

### BUSES AND TRACTORS

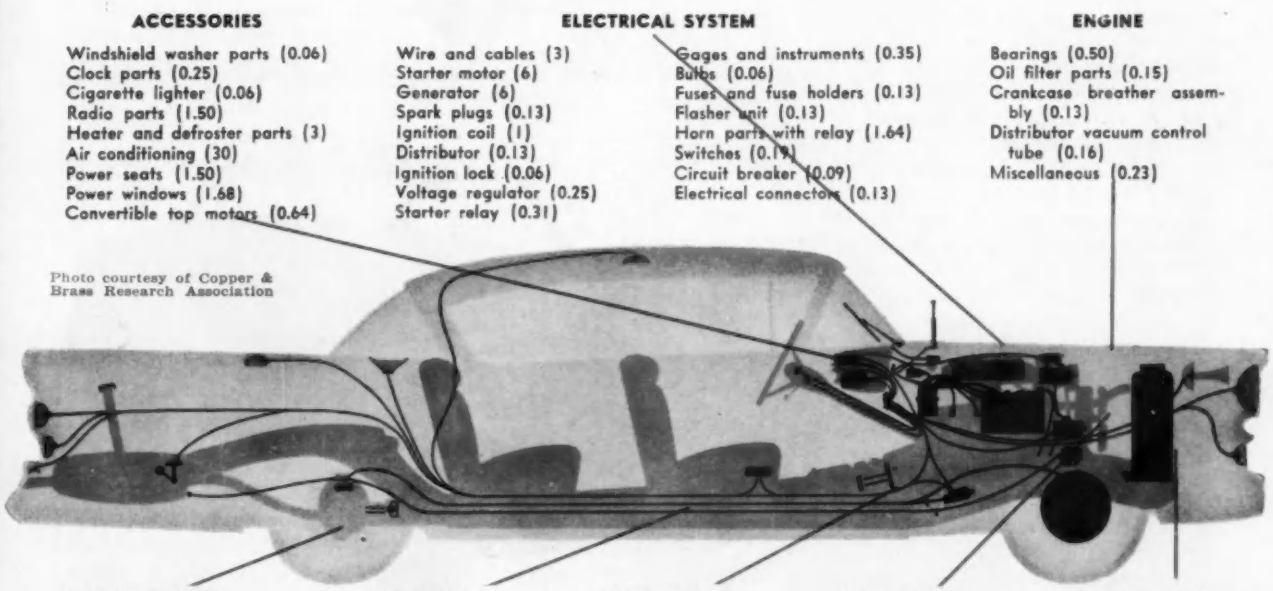
A large proportion of the buses being produced today are equipped with air conditioning systems using about 80 lb of copper products. Many of the components common to passenger cars, such as heaters and automatic transmissions, are also used in buses in larger sizes. The average bus, as a whole, buses in larger sizes. The average bus probably uses in excess of 100 lb of the red metal and its alloys.

Factory sales of buses in 1956 amounted to approximately 4000 units and seem certain to exceed that mark this year and in the future, when such factors as the continuous growth of suburban areas, the steady replacement of trolley cars by buses, and expanding school construction are taken into account. The some 400,000 lb of copper products used by the bus industry in 1956 should take a sharp upturn in 1957 and in the years ahead.

Bureau of the Census figures show that factory sales of wheel-type and tracklaying tractors in 1956 were 215,656 and 57,365 units, respectively. AUTOMOTIVE INDUSTRIES estimates that the former utilized an average of 35 lb of copper and its alloys per unit, whereas the latter averaged 47 lb.

The wheel-type machines consumed approximately 7.6 million lb of copper, brass, and bronze, and the tracklaying type accounted for nearly 2.7 million lb in 1956. These figures, too, should rise in the years ahead with increasing mechanization on the farm and a booming construction program.

# Find Many Uses in Automotive Vehicles




**COPPER AND ITS ALLOYS USED IN A TYPICAL PASSENGER CAR**
*(outlined in black—estimated poundages in parentheses)*

# Communist-Built Motor Vehicles Displayed at Leipzig Fair

## By David Scott

THE Leipzig Fair in March indicated that the East German car industry is still striving to expand output and to improve the market appeal of its models. Production in 1956 was officially disclosed as 27,300 units, a 23 per cent rise over the year before, and the planned target for this year is some 45,000. While this is a substantial increase it is still well below the 1936 figure of over 60,000 cars made in that part of the country.

With East Germany severed from the Ruhr, steel supplies have become a major bottleneck, and sheet is particularly short. This situation has been aggravated by the reduced deliveries of Polish coal, on which the region's small metallurgical industry depended heavily. Now it is energetically seeking to buy steel from outside the Communist bloc, and during the fair there were reports of several deals concluded with West German producers, who exhibited at Leipzig on a very large scale.

Inadequate investment in car factories has been another weak point, since wartime destruction, reparations to Russia of machinery from current production, and a low priority for re-equipment left East German plants in a backward state. This neglect is apparently now to be tackled seriously, and machinery exhibits at the fair by the local machine tool industry suggested that manufacture of a wide range of automatic and semi-automatic equipment especially for automotive production has begun.

While East Germany presented no entirely new cars, there were several examples of novel bodywork on existing chassis. One was a sports version of the 55-cu in. Wartburg introduced last year as a four-door sedan. With a low-slung two-passenger body resembling a scaled-down Mercedes 190 SL, it was shown both as a convertible and with a detachable hardtop. Output of the three-

*Wartburg station wagon has wrap-over side windows at the rear and a folding sun roof*

*Plastic body and steel roof are combined on the P-70 Zwickau coupe. Thin pillars provide a large glass area. It has a 22-hp, two-cylinder engine with front-wheel drive*

*East Germany's RS 14/30 was exhibited with half-track attachment. Engine is a two-cylinder Diesel developing 30 hp at 1500 rpm. Front wheels are carried on individual coil springs housed in the steering knuckles*

cylinder, two-stroke engine is increased to 50 hp at 4200 rpm by using twin carburetors, higher compression and improved breathing. Drive to the front wheels is through a four-speed gearbox synchronized on the top two ratios.

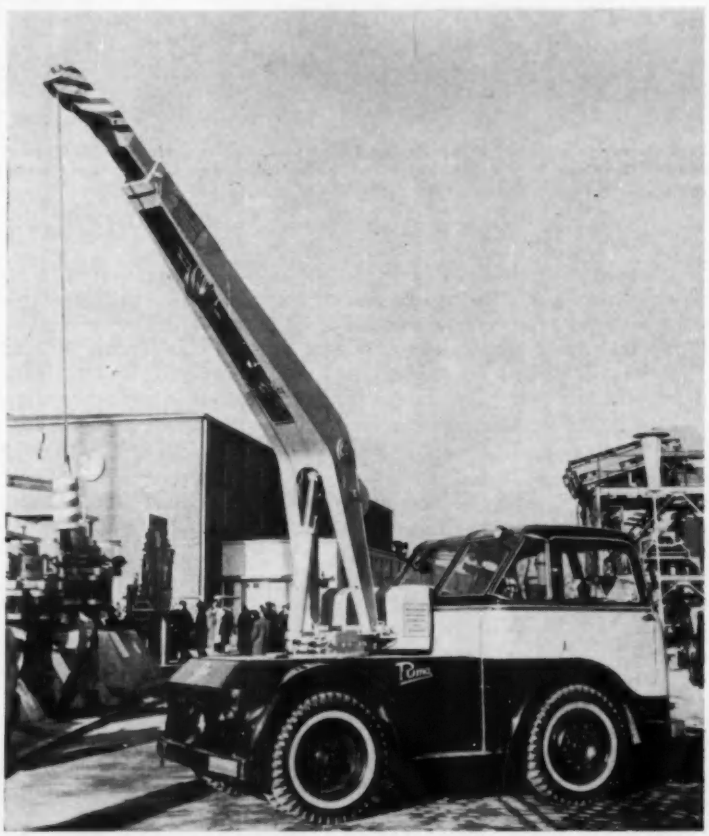
Reviving the style of the open-air taxi, the Wartburg Bellevue combined a convertible at the rear with a transparent-roofed hardtop in front. This construction with a two-door body is claimed to approach the box-like strength and safety of the conventional sedan. The first hand-built prototype was on show, and series production is planned to start in August.

A station wagon on the same 37-hp chassis featured wrap-over side windows at the back and a fabric sliding roof panel. Designed for camping, it has folding seats that form a double bed, and the side-hinged tail door permits easy loading and access to a lower shelf carrying the spare tire and tools.

A new coupe version of the Wartburg also converts into a bed. Backrests of the individual front seats jack-knife forward as pillows, and sleepers' legs extend into the large trunk.

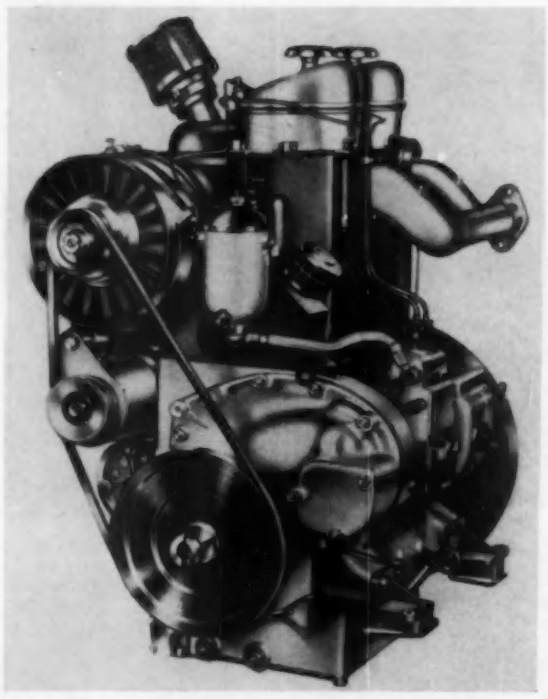
Further restyling was seen on the small P-70 Zwickau with front-wheel drive. As a two-passenger coupe, it has a plastic body of resin-bonded glass fiber with a pressed-steel roof. Slender supporting pillars provide a large glass area and good visibility. The 42 cu in. two-cylinder engine develops 22 hp at 3500 rpm.

There are several minor alterations in the basic P-70 sedan, including a bimetallic thermostat fitted to the radiator hose which operates a yellow light on the dash when water temperature is below 140 deg F, and a red one if above 205. As a station wagon this model has a cargo volume of 70 cu ft.

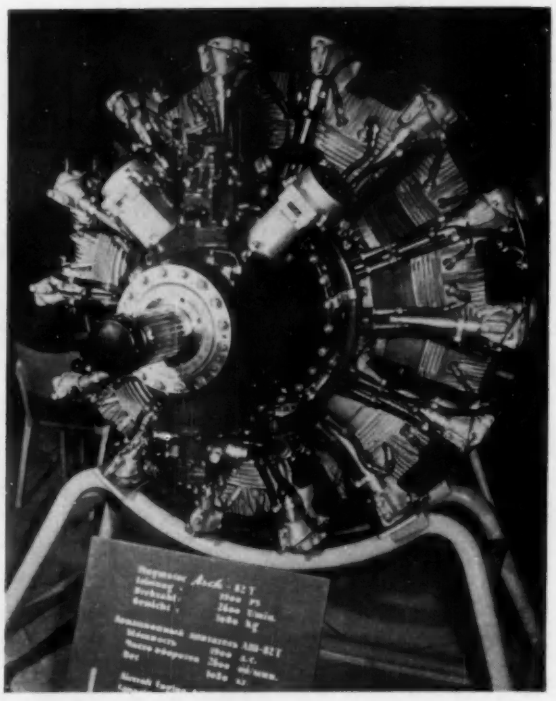


*East German autocrane has a two-way cab that permits the operator to face in either direction*

Design improvements were also noted on some of the East German tractors. The largest wheeled machine on show was a 7050-lb Harz. Made in Nordhausen, it has a four-cylinder Diesel engine rated at 40 hp at 1250 rpm. The transmission has five forward ratios giving a top speed of 10 mph. Front wheels are individually sprung by coil springs incorporated in the steer-



*Two-cylinder version of a new line of East German aircooled Diesels develops 17 hp at 2000 rpm. Piston displacement is 97.5 cu in., compression ratio 18 to 1, and weight 520 lb.*



*This 14-cyl engine for East Germany's first commercial airliner develops 1900 hp at 2600 rpm. Of Soviet design, it powers the IL-14P*

ing knuckles on the pivoted beam axle. These also raise ground clearance to 12½ in. A smaller 30-hp tractor of similar construction was exhibited in half-track form.

The RS-09 implement carrier, seen previously at Leipzig, is now offered with a dump body as an accessory. The bucket with associated tipping mechanism is mounted on the central backbone, and drive is taken from the forward pto. This multipurpose tractor has an 18-hp Diesel engine placed directly over the rear axle and beneath the driver's seat, and the reversible transmission has eight speeds in each direction.

One new development in industrial vehicles was a truck-mounted crane with a bi-directional cab. Duplication of controls permits the operator to face forward for road driving, or rearwards to view the hoist mechanism as well as drive. Of cab-over-engine design, the eight-ft wide body encloses the 52-hp air-cooled Diesel. The hydraulically-operated crane has a lifting capacity of one ton with the extendable arm at its maximum radius of 19 ft, or three tons at minimum radius.

The Zittau truck factory (recently renamed Robur-Werke) has introduced a new range of aircooled Diesels sharing many parts in common with its existing four-cylinder engine. The series is in 1, 2 and 3 cylinders, and in V-6 and V-8 form. These have 3.6-in. bore and 5-in. stroke, with each 48.8-cu in. cylinder rated at 8.5 hp

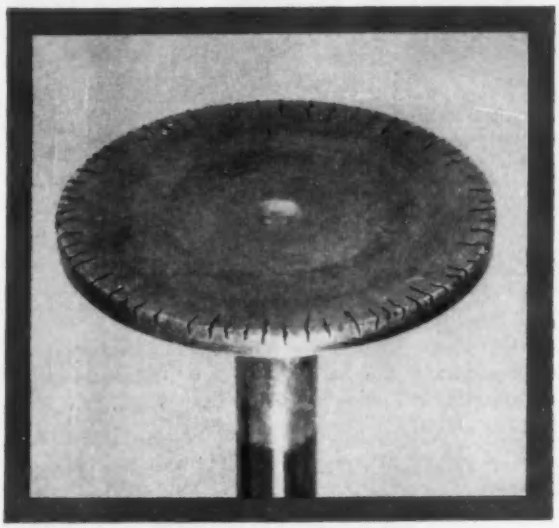
(*Turn to page* 120, *please*)

*Russia's first automatic transmission is incorporated in the medium-sized Volga. The 137 cu in. engine is rated at 70 hp at 4000 rpm.*

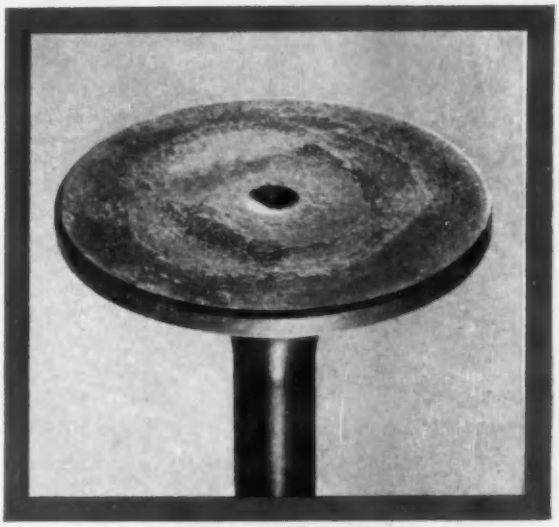
*Accelerated Engine Test Comparison Proves*

# EATON SUPER-ALLOY VALVES LAST MANY TIMES AS LONG

**AS VALVES MADE FROM COMMONLY USED ALLOYS**



**COMMONLY USED ALLOY**
Failed at Less than
600 Hours

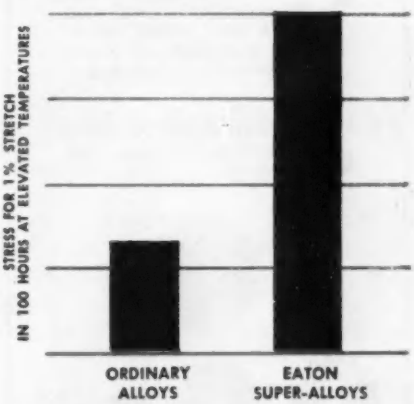


**EATON SUPER-ALLOY**
in Excellent Condition
after 3000 Hours

**To meet the requirements of extreme heavy duty service, Eaton has developed unique production methods for the making of exhaust valves of super-alloys possessing exceptionally high hot-strength and corrosion resistant properties. These Eaton Super-Alloy Valves are "custom tailored" to meet the specific requirements of the engines for which they are designed.**

**As a pioneer in the development of valve designs and materials which have added thousands of miles to valve life expectancy, Eaton has made such important contributions as sodium cooled valves, seat-faces of high-alloy materials, aluminized valves, and now super-alloy valves.**

**If you build engines—either gasoline or diesel—for heavy duty applications such as motor trucks, buses, earth moving machinery —it will pay you to discuss the advantages of Eaton Super-Alloy Valves with our engineers.**




**The results of laboratory tests represented by the above graph indicate the superior hot-strength of Eaton Super-Alloys over commonly used exhaust valve materials.**

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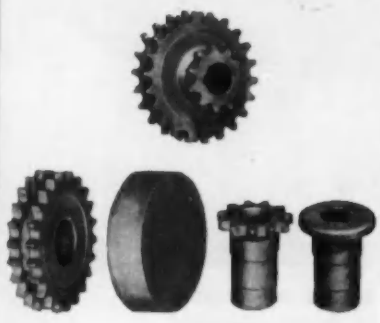
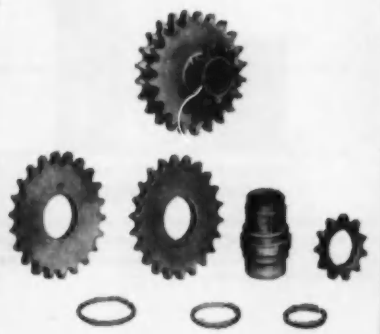


Before, sprocket was machined and hobbed from solid metal, then welded. Now, three stampings are EASY-FLO-brazed to turned hub.

Result—sprocket made stronger in less time, with less metal.



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HANDY HI-TEMP FOR HIGH-TEMPERATURE BRAZING

PRODUCTION LINE BRAZING DEMONSTRATION

## Clever, these Design Engineers!

The cleverest designers of all are those who know that silver alloy brazing, specified as the joining method at the *design stage*, can be of great value. The benefits that go hand in hand with brazing—of cost, of time, of labor, of product superiority, warrant consideration from the start.

Examples of how design for brazing simplifies production and improves the product are numerous . . . to give you an idea of what can be saved through Handy & Harman silver alloy brazing with EASY-FLO 45, take a look at this:

### Triple Sprocket for Self-Propelled Combine

Originally, double sprocket was bored, turned and hobbed from solid stock; small sprocket and hub were turned from single piece of bar stock. Large sprocket was then welded to hub as shown.

Redesigned for EASY-FLO brazing, large and small sprockets are blanked from 1/2″ plate and bored and hobbed in groups; hub is turned from much smaller diameter bar stock. Three rings of 1/16″ EASY-FLO wire join the entire assembly. All joints are Handy-Fluxed. Large sprockets and hub are jigged with one preplaced ring of EASY-FLO around hub above each sprocket and induction-brazed in 30 seconds. Third EASY-FLO ring brazes small sprocket to hub end in 17 seconds. Total: 47 seconds for completed assembly. Results: Lower over-all production costs due to savings in metal, machining and joining time. A stronger sprocket due to full-area penetration of the alloy.

This is just one example of the benefits enjoyed with one Handy & Harman alloy and brazing method. We'll be happy indeed to talk to you about all kinds of silver brazing alloys and their attendant benefits. We have found that if we join forces right at the start, the results are right . . . all the way. Just call us.

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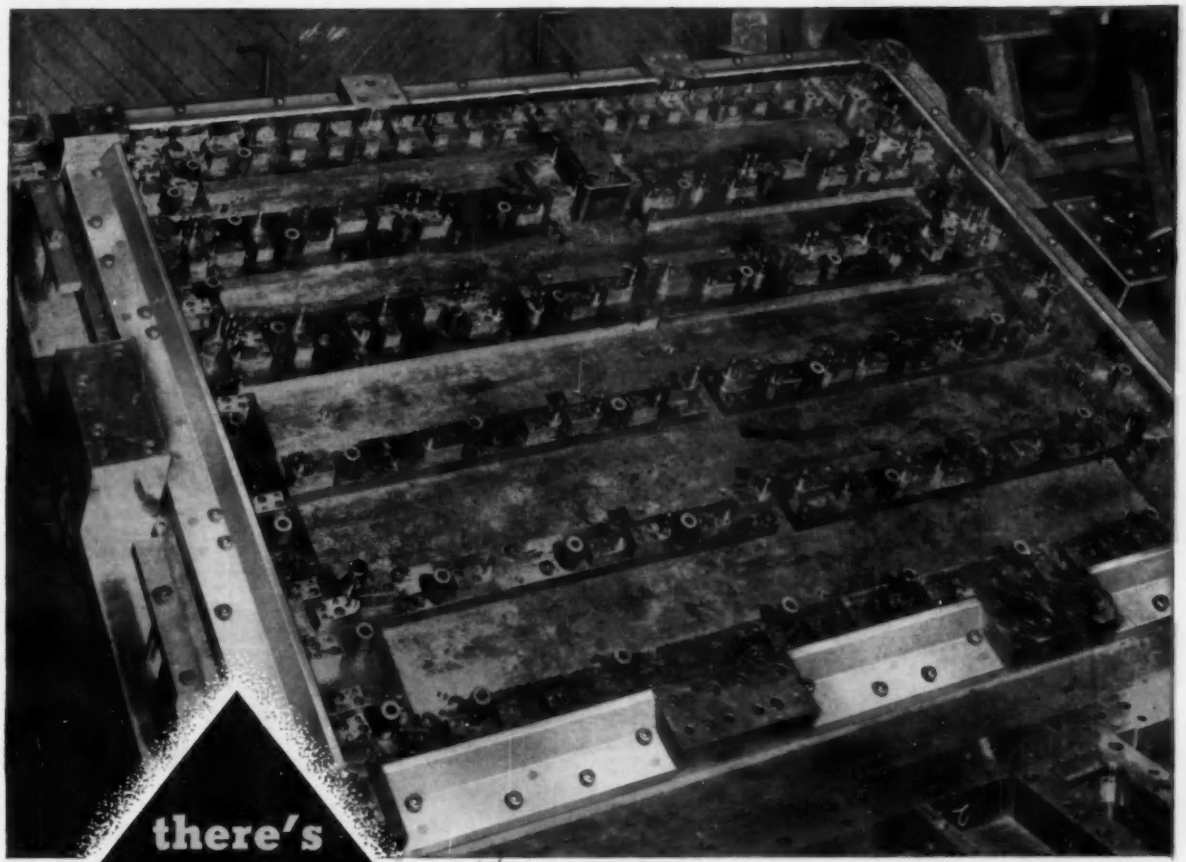
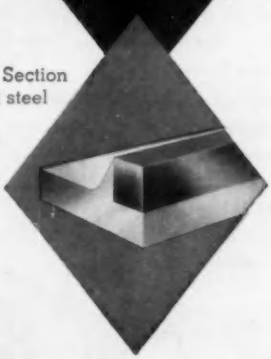


Photograph courtesy of the Ready Machine Tool & Die Company, Inc., Connersville, Ind. shows Ohio Knife Co. Composite Die Sections on a blank and pierce die for a 4' x 6' refrigerator inner food compartment.

# there's a NEW way to build your dies

## it saves you time and money

**OK** Die Section shows tool steel clad to mild steel backing.



You simply order from our large stock of Composite Die Sections. They are cut to your required length or in bars 125" long. There are eleven standard cross sections with both wide and narrow lands available.

You buy them at a price far below what it's costing you to make them yourself.

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Hundreds of companies who have switched to OK Composite Die Sections available for Cutting, Trimming and Forming Dies, report great time and money savings, plus longer die life. For new bulletin on OK Composite Die Sections and Clad Aluminum Bronze Wear Plates, write Dept. 47-AB.

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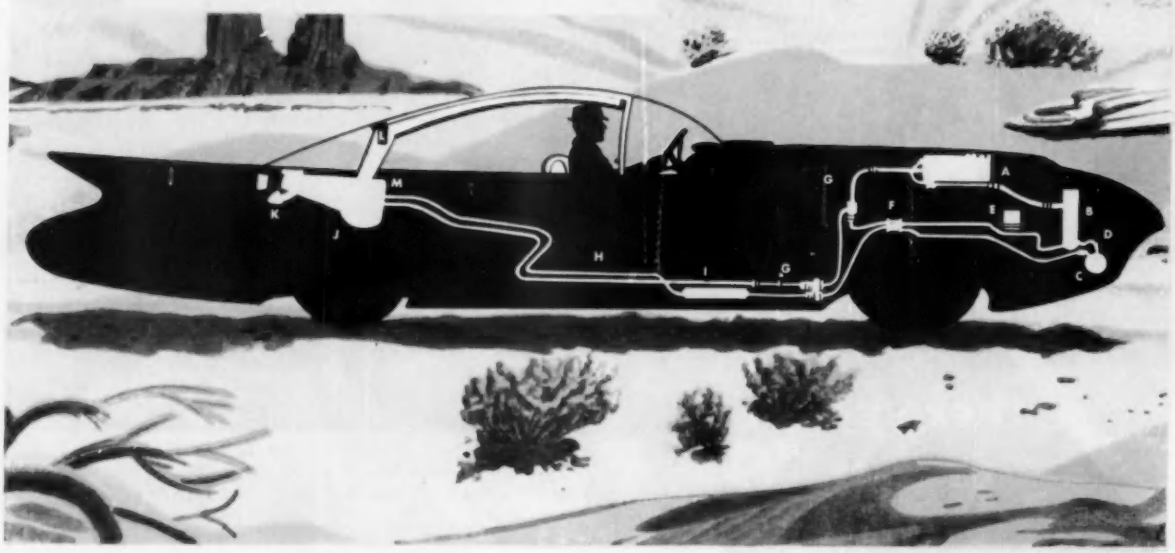
A. Compressor
B. Condenser
C. Receiver
D. Receiver Check Valve
E. Metering Solenoid
F. Liquid Line Sight Glass
G. Flexible Connectors in Refrigerant Suction and Discharge Lines
H. Refrigerant Lines Clamped to Frame Beneath Car
I. Liquid Line Dehydrator and Filter
J. Evaporator and Blower Assembly
K. Fresh Air Intake
L. Discharge Ducts and Air Distribution Grilles
M. Return Air Grilles on Package Shelf



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Paracrils are Naugatuck's butadiene acrylonitrile rubbers. Rubbers capable of carrying refrigerants while possessing outstanding resistance to oils, fuels, aromatic hydrocarbons and many hydraulic fluids. In addition Paracrils provide:

- **superior aging resistance, even at elevated temperatures,**
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For complete information on how the *oil-resistant Paracril* family can help you improve or develop a product, write to us, *today*.

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# NEW PRODUCTION and PLANT EQUIPMENT

*FOR ADDITIONAL INFORMATION, please use reply card on PAGE 89*

## Small Air Hammer

MEASURING only six inches long and weighing 20 oz, an air hammer just introduced can be operated with one hand, leaving the other free to handle the work. Called the Bantam Bully, its metering trigger lets the operator control blows per minute from 0 to 13,000. Air consumption is 6.5 cmf at 90 psi. Twenty-four different tools for scaling, chiseling, peening, cutting, star drilling, etc. are available for use with the unit. A slip chuck snaps the various tools in or out easily and can be locked in eight different positions. *Superior Pneumatic and Mfg., Inc.*

**Circle 30 on postcard for more data**

## Displacement Follower

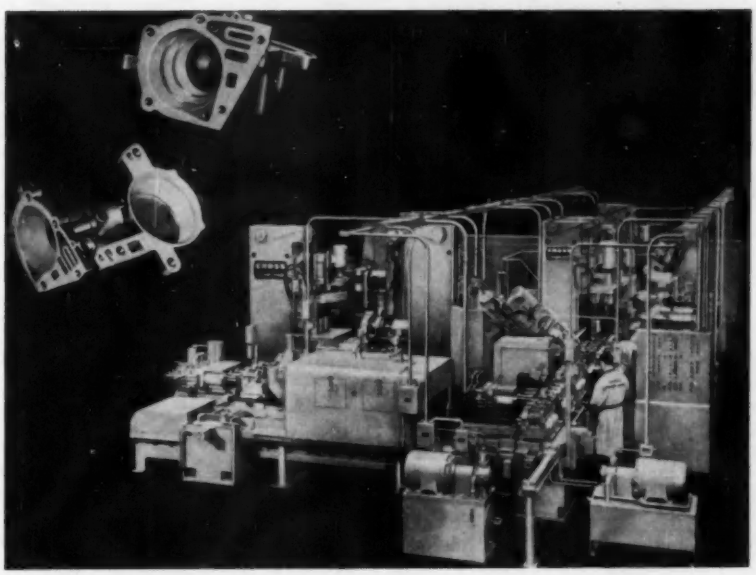
EMPLOYING the "captured spot" principle, an optical-electronic device called the Optron has been introduced for measuring displacement and vibration of moving objects. It may be used to measure the amplitude, frequency and waveform of shake

*Optron basic unit mounted on tripod*

tables, vibration pickups, accelerometers and relay contacts, and to measure the runout of shafts and other rotating parts. No contact is made with the work, and it is usable on any material regardless of size, shape or composition.

The basic displacement follower unit includes a cathode ray tube, a multiplier phototube, an optical system and an amplifier. The power supply is a separate unit. Motion in any plane may be measured and the waveform of the motion displayed on a conventional oscilloscope. In operation a spot of light (effective diameter 0.0001-in.) from the cathode ray tube is projected by the optical system (100x microscope) onto the work. The multiplier photocell locates this spot to follow the motion, which is shown on the oscilloscope. Accuracies of measurement are in microinches. Full scale range may be as high as 10 in. with different optical systems. *Optron Corp.*

**Circle 32 on postcard for more data**



*Cross Transfer-matic completely machines servo valve bodies for automatic transmissions at the rate of 490 pieces per hour at 100 per cent efficiency*

## Transfer Unit Machines Servo Valve Bodies

IN machining servo valve bodies for automatic transmissions, the latest Transfer-matic produces parts at the rate of 490 pieces per hour at 100 per cent efficiency. It performs 21 drilling, six reaming, five tapping, six boring, and two precision-facing operations.

The parts travel through 25 stations: one loading, nine drilling, one tapping, two rough boring, two precision boring, two precision facing, one washing, six visual inspection and one unloading. Palletized workholding fixtures each carry three parts. An unloading unit is provided for removing parts from the fixtures and placing them on a conveyor.

Design of the machine incorporates interchangeability of all standard and special parts for easy maintenance and the company's "building block" construction to provide flexibility for future design changes. Other stated features include an automatic washing unit for fixtures; hydraulic feed and rapid traverse for milling, drilling and boring; and individual lead screw feed for tapping. *The Cross Co.*

**Circle 31 on postcard for more data**

*Colonial ram press broaching machine equipped with automatic indexing table. In one application using a 180-deg index, two rockerarm assemblies are manually loaded at one time, automatically clamped, double broached in one pass, and chute ejected. Cycle time at 100 per cent efficiency is six seconds; and production rate is 1200 per hour.*

## Broaching Machine with New Indexing Table

MOST models of a ram press broaching machine line can be supplied and made more productive with a new indexing table recently developed, according to an announcement. The automatic table uses a 180-deg. index, and is manually fed and automatically unloaded. Stated features of the table include: self-locking of the fixture by the indexing action; precision alignment; and high performance with safety.

Set up for an automotive manufacturer, a 4-ton capacity, 24-in. stroke model with the integrated table, broaches 1200 rockerarm assemblies per hour. The parts are loaded two at a time, automatically clamped, double broached in one pass, and automatically ejected.

Other models in the line are rated at 6 and 10 tons. The addition of the new indexing table increases their adaptability to automatic operation. Automatic loading and transfer-type installations are available. *Colonial Broach and Machine Co.*

**Circle 33 on postcard for more data**

## Boring Bars

HAVING individual micro-adjustment of anvils, a new line of boring bars combines multi-diameter boring and even chamfering operations in the same tool. Throw-away inserts requiring no grinding are used in each location. The anvil on which each insert is locked, is micro-adjustable in and out. Each division of the screw-dials represents 0.001-in. on diameter. When inserts are dull, they can be indexed to an unused edge or interchanged. Precision grinding of the throw-away inserts is said to eliminate the need for adjustment when inserts are changed. *Wesson Co.*

*Wesson micro-adjustable boring bars designed for multi-diameter boring, and multi-diameter boring and chamfering.*

**Circle 34 on postcard for more data**

## Carbide Tools

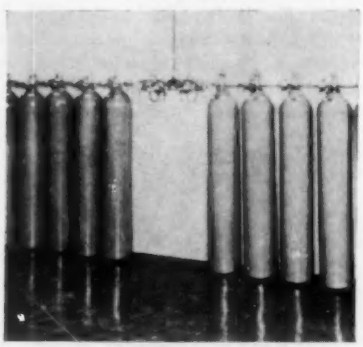
THE announcement of a special brazing-hardening process, used in making a line of carbide tools, states that the process enables the carbide tip to be brazed at the same time the high-speed-steel body is hardened. According to the manufacturer, this results in uniform body hardness and carbide tips that will not loosen due to braze failure. It is further stated that "Perma-Braze" carbide drills can be used for dry drilling of cast iron without fear of braze softening or melting. *Whitman & Barnes.*

**Circle 35 on postcard for more data**

## Oxygen Manifold

THE Oxweld M-35, a new oxygen cylinder manifold designed to handle an unlimited number of cylinders, has been introduced. As a basic unit it accommodates two cylinders, one on each side of the operating controls. Straight or curved extensions are then added in single or double rows to either bank, so that it is possible to manifold any number of cylinders. This makes it possible for the unit to supply any desired amount of oxygen to a piping system for welding, cutting, and other industrial uses.

One bank of cylinders can be operated independently while cylinders in the other bank are in reserve or being changed. When large flows are needed, both banks can be operated simultaneously. During alternate operation, the reserve cylinder bank automatically picks up the oxygen load when the supply in the operating bank is exhausted. This feature makes it possible to leave the manifold completely unattended until all cylinders have been used. Cylinders can be added or removed at any time to meet changing conditions. All controls are conveniently grouped and easily accessible.



*Oxweld M-35 oxygen manifold.*

New Oxweld manifolds similar in operation to the M-35 are also available for water- or oil-pumped inert gases, such as argon, nitrogen, and helium; for high-pressure fuel gases, such as hydrogen and methane; and for liquefied petroleum gases, such as propane, butane, and pyrofax. *Linde Air Products Co.*

**Circle 36 on postcard for more data**

## All-Air Valve Circuit

FOR providing safety to operators of presses, brakes, shears and other machines, an all-air circuit has been announced. It features a non-tie-down valve, a single stroke valve, and a three-way poppet palm button valve arrangement. Company engineers state the circuit assures increased operator safety because it requires two-handed operation to cause a machine cycle. Only one stroke occurs regardless of how long the palm button valves are held down. The buttons must be released to clear the circuit and again depressed to allow another stroke.

The non-tie-down valve was designed with a protected adjusting screw. Regulation of this screw permits a variable time lag between the depression of the first palm button valve and the second palm button valve. The valve has also been so designed that its own malfunctioning will automatically cause the system to be inoperative.

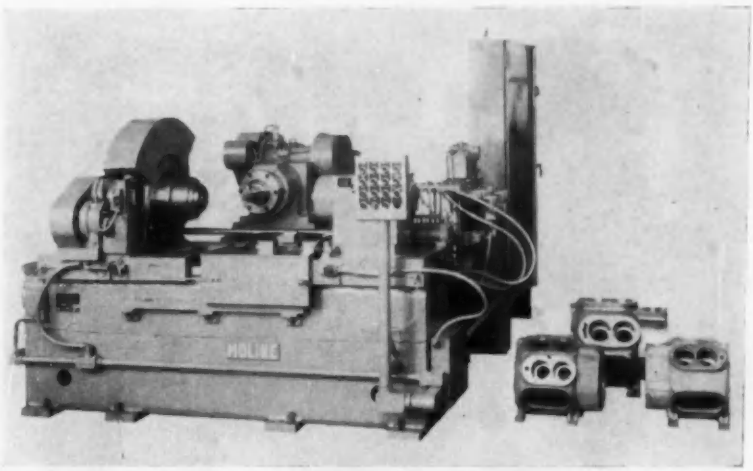
The palm button valves, designed specifically for use with the firm's new non-tie-down valve, are available with or without a cylinder key lock. The key lock valves are used in installations requiring multiple station operation where one or more stations are occasionally locked out of the circuit.

For press applications, the single stroke valve can be used in a circuit with the non-tie-down and palm button valves. With the single stroke valve in the operating circuit, it permits only one cycle regardless of how long the operator holds the palm button depressed, and requires removing his hands and again depressing the palm button valves.

Components can be added to the non-tie-down and single stroke circuit to provide the following functions: Emergency stop—used to stop the press at any point of its stroke; continuous—used when press is put on automatic cycling and material is fed through the press continuously; top stop—permitting stopping of the press run at the top dead center position, after the press has been running on continuous cycle.

Other components can be: Inching—permitting starting and stopping the press at will during setup operations; pneumatic interlock—permitting the operator to release the control buttons on single stroke operation before the full stroke is completed, without having the press stop until the run is at top dead center; and a selector valve—used to preselect any one of the desired press cycles, thus permitting the press to be actuated only with the type operation selected for specific jobs. *Ross Operating Valve Co.*

Circle 37 on postcard for more data



*Moline Model MR149 single-spindle boring machine features automatic operation in processing compressor crankcases to receive cylinder sleeves*

## Special Machine Bores Compressor Crankcases

SPECIALLY-DESIGNED for boring two different sizes of four, six and eight-cylinder compressor crankcases to receive cylinder sleeves, the Model MR149 single-spindle machine illustrated features completely automatic operation once the part is loaded into the fixture.

The horizontal boring spindle unit moves by hydraulic power on hardened and ground steel ways and is provided with rapid traverse in two directions, adjustable rate of coarse feed for boring, and adjustable rate of fine feed for facing, together with timed dwell against a positive stop for cleanup of facing to depth.

After a crankcase is loaded into the fixture, it is located and clamped endwise by hydraulic power. The automatic cycle then is started, with boring and indexing following a preset sequence until all operations are completed. As soon as the tools are withdrawn at completion of work on a bore, the crankcase is indexed longitudinally and radially as required to bring the next hole into position for boring. After all holes have been bored, the fixture indexes the work into position, ready for unloading.

Operations include rough bore, counterbore top and bottom bores, and face bottom bores. Changeover, from one size crankcase to another, can be accomplished in a matter of minutes. *Moline Tool Co.*

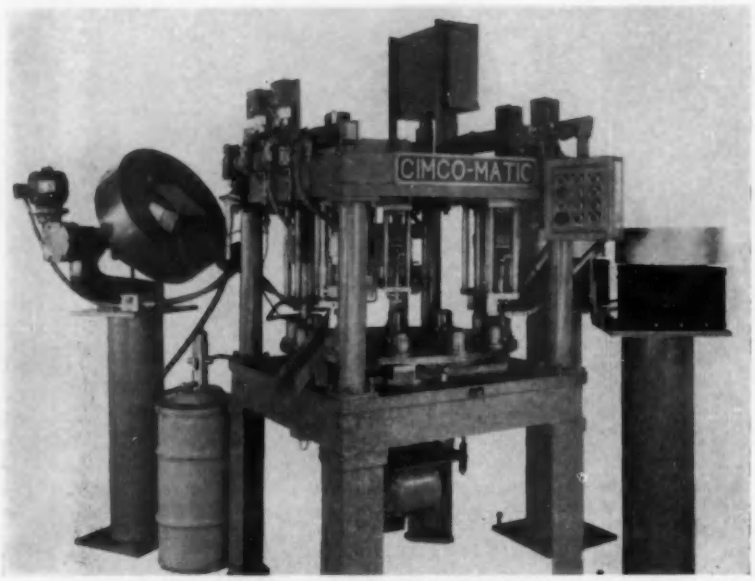
Circle 38 on postcard for more data

## Production Counters

NOW being marketed is a new line of counters which is said to be low in cost and to be sturdily built for continuous operation on presses and high-speed production machines. The complete Tally-King line includes six models capable of handling a variety of counting operations. No. TK-4, available in either ratchet or revolution type, features an "error-proof" mechanism which stops automatically if an error occurs. This model counts up to 99,999 at speeds up to 2000 counts per minute. Other models produce counts from 9999 down to 99. *Faymus Div., Bankers & Merchants, Inc.*


*Tally-King production counter.*

Circle 39 on postcard for more data




*Cimco 12-station machine assembles bearings in automotive parts*

## Assembly Machine for Bearing Assemblies

DESIGNED primarily for assembling bearing assemblies for a 1957 model car, a special machine has a 12-station index table with 36-in. dial plate, pneumatically-operated work stations, and electrical control system. It is producing 900 assemblies per hour with one operator. All work stations are built around standard tooling support units suspended from the top plate, which is said to permit ready machine modification for part changes.

The sequence of operation of the machine is: Stations 1 and 2, hand load sleeve; 3, hopper feed and orient outer race and press it into sleeve; 4, hopper feed inner race. Station 5 is idle; 6, feed and count 23, ⅛-in. diam balls; 7, press outer and inner races into proper position in sleeve. Station 8, feed and orient contact plate into position over sleeve and press into sleeve; 9, idle; 10, grease bearing; 11, eject assembled part; and 12, idle.

Special-purpose assembly machines made by the company are built up from standard component units. These include 16, 24 and 36-in. index tables available in 6, 8 or 12 stations; 36, 48 and 54-in. standard four part assembly units, and standard work stations, which when combined with a feeding unit, feed, orient and transfer the part into the tooling fixture on the dial plate. *Cimco Engineering Co.*

**Circle 41 on postcard for more data**

## Automatic Soldering Machine for Small Parts

*Named Braze-O-Matic, the machine pictured automatically feeds solder through magazines to preheated parts, for solder fabrication. Its timing mechanism operates and regulates the flame and supplies the exact amount of solder, in conjunction with an index table. Heat is localized at the point of fabrication in much the same manner as would be done manually, providing increased production rates. The machine has a signal system which gives lead time in calling for replenishment of supplies. It is said to operate efficiently with all known forms of soldering and all types of metals. (Castle Machines, Inc.)*

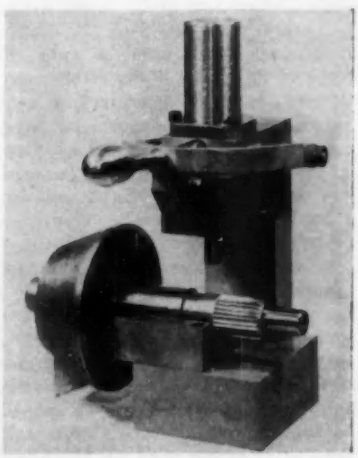
**Circle 40 on postcard for more data**

## Percussion Press

ILLUSTRATED is a hand-operated spring percussion press for marking metal components at production machines. The component to be marked is placed in the fixture and the percussion spring cocked by downward pressure on the handle. The spring is released automatically at a fixed position.

Capacity of the unit is six 1/16-in. characters. The fixtures are built to order. The press can be furnished with any type of base for mounting to machine. *Geo. T. Schmidt, Inc.*

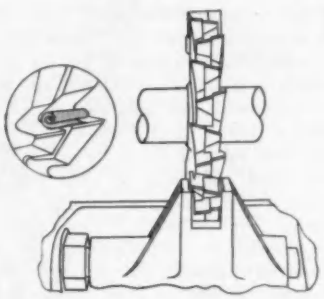
**Circle 42 on postcard for more data**



*Schmidt bench style marking press*

## Interlocking Cutters

INTERLOCKING staggered-tooth side milling cutters, in an improved line, have been announced. The patented positioning of the teeth provides for the trailing edge of the leading section to be slightly ahead of the leading edge of the trailing section. This feature is said to eliminate any obstruction to the free flow of chips across the cutting face. And that because of this free-flowing chip action, the cutting edges produce more pieces per sharpening, tooth breakage and cutting temperatures are reduced, and increased feeds and speeds are possible. Depth of cut may be as great as the depth of cutter hub.



*Barber-Colman interlocking staggered tooth side milling cutter*

The interlocking feature permits the use of shims to accurately keep the cutter at its normal cutting width throughout its life. By varying the thickness of the shims, it is possible to use the same cutter for several widths of slots.

Cutters of this type are recommended by the company for deep slotting cuts in steel, shoulder cuts, and for milling operations where depth of cut exceeds the width of cutting face. They work equally well in steel or soft non-ferrous materials. *Barber-Colman Co.*

Circle 43 on postcard for more data

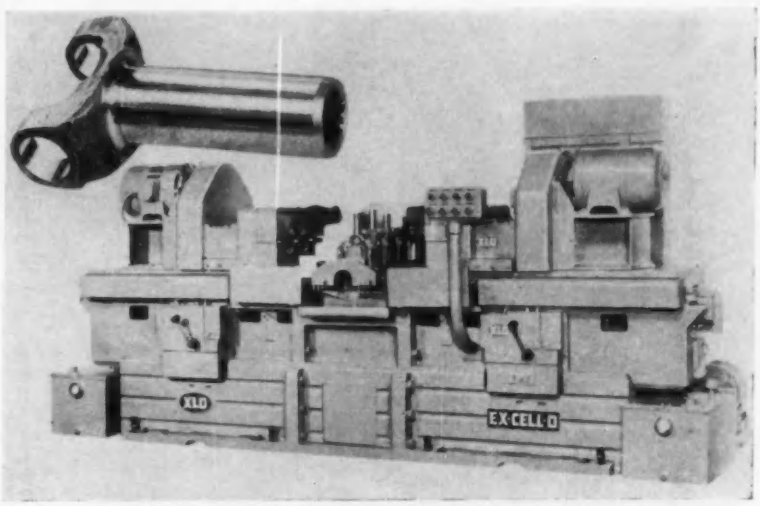
## Electronic Comparator

DIMENSIONAL variations as small as one millionth of an inch can be detected with a super-sensitive electronic comparator recently developed, according to an announcement. Designated as Model 130 B-9, it was originally built to measure precision ball bearings, but is adjustable and may be used for parts of various shapes and sizes.

The gage consists of three parts, an electronic amplifier, an indicating meter, and an electronic gage head mounted on a base with an adjustable column to permit vertical positioning. The gaging spindle is mounted within the gage head on pantograph reed springs to provide frictionless motion transfer. This makes it very sensitive to the minutest variation in workpiece size and gives it repetitive accuracy. The construction also makes it possible to measure with a minimum gaging pressure, avoiding distortion or marking of thin-walled or highly-polished parts.

Any one of four magnifications can be selected quickly by switching. They range from 60,000 to 1 (0.000001-in. graduations), to 2000 to 1 (0.000030-in. graduations). *Federal Products Co.*

Circle 45 on postcard for more data




## Two-Way Machine Speeds Boring Operation

*Production of yokes for universal joints is said to have been increased appreciably in the plant of an automotive parts supplier by the two-way precision boring machine illustrated, which permits simultaneous operations at both ends of the part. Made of malleable iron, the yokes are fixture-clamped and two holes are finish-bored in line. A three-station, hydraulically-operated fixture and three boring spindles on each slide of the machine produce three machined yokes in each automatic cycle. (Ex-Cell-O Corp.)*

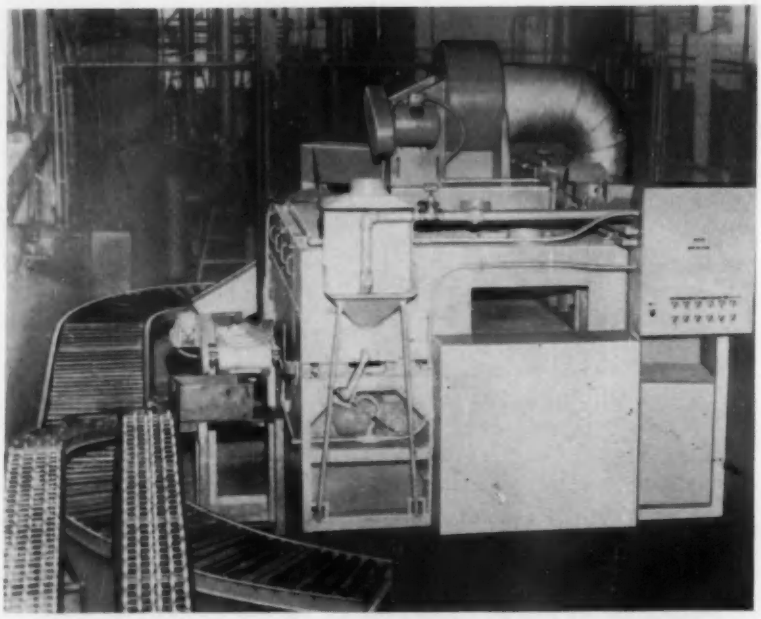
Circle 44 on postcard for more data

## Centerless Grinder

FEATURING versatility, the TG-12 centerless grinder is being offered for the centerless grinding of tungsten carbides, steels, stainless, plastic, ceramics, carbon, fibre, cork, and nonferrous metals. Tolerances of ±0.0002-in. and finishes of 6 to 8 microinches are reported to be obtained. It handles work from 0.004 to 1½-in. diam; and may be used for either plunge or through-feed grinding. Also featured are: increased ease and speed of setup time through greater accessibility to work zone area, rapid replacement of the work wheel, a hydraulic system for automatic cycling, and elimination of machine warmup time through the incorporation of precision preloaded bearings in the spindle design. *Royal Master, Inc.*

*Royal Master TG-12 centerless grinder*

Circle 46 on postcard for more data



*Ransohoff combination continuous drum and belt conveyor type cleaning machine*

## Two-In-One Multi-Process Cleaning Machine

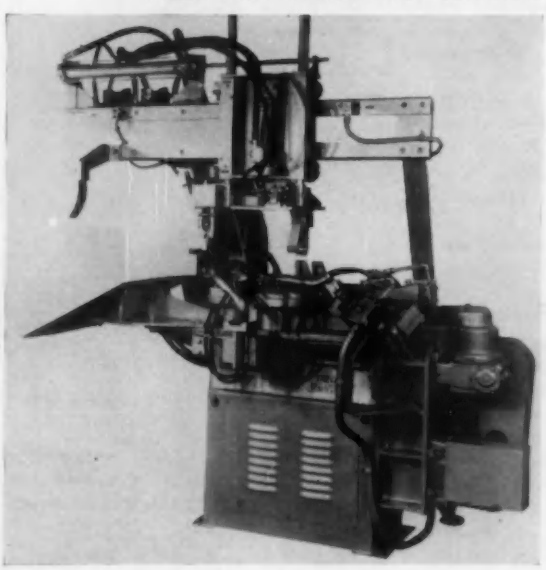
COMPRISING two integrated sections, a cleaning machine recently exhibited is a combination continuous drum and belt conveyor type unit. Small work or parts are washed, rinsed and dried in the drum section, and larger work or tote pans are processed at the same time in the conveyor section. The drum and conveyor type components are contained side-by-side in the same machine housing and integrated so that the same pumps, tanks, blowers and heating equipment serve both sides.

Design of the machine is versatile to permit incorporation of pickling, neutralizing, phosphate coating or similar processes. Tanks and drying air may be heated by gas, steam, oil or electricity as required.

One-man operation is provided by return conveyors. Small work or parts processed in the drum section are automatically returned by belt conveyor to the charging end. Larger parts processed in the conveyor section are discharged onto a gravity type conveyor for return to the charging end. Completely automatic operation can be furnished by integrated loading, unloading and transfer equipment. *Ransohoff, Inc.*

**Circle 48 on postcard for more data**

## Flash Butt Welder for Exhaust Pipes

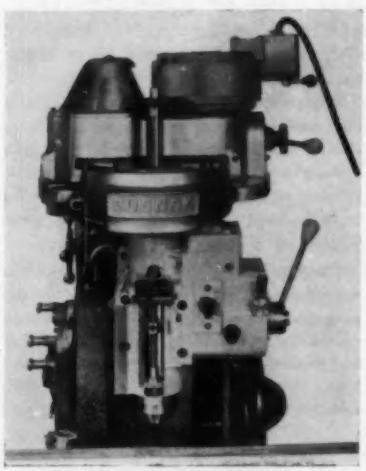


*This special flash butt welder joins the ends of curved pipes that form part of an automobile exhaust cross-over assembly. It welds the pieces at the rate of 240 per hour. Upper structure is a pick-up and transfer mechanism for automatic loading. Special tooling includes motor-driven upset and horizontal air clamp. The machine is rated at 75 kva. (The Taylor-Winfield Corp.)*

**Circle 47 on postcard for more data**

## Mill Head

THE recently-introduced No. 120 milling machine mill head offers infinite spindle speeds of 100 to 3600 rpm in two ranges, 100 to 600 and 600 to 3600, with one belt change. Also infinite power feeds from 0 to 0.012-ipr both up and down. Feed is dial controlled, and rate of feed can be selected with machine running, standing still, or under load. The feed can be disengaged automatically or by hand. Micrometer nut is power feed kick-off; on reverse feed, safety kicks off at end of stroke. Other features are a feed thrust of 800 lb, with safety overload clutch which clicks when overloading feed; a five-inch quill travel; and a hardened quill over 12½ in. long.



*Rusnok No. 120 mill head.*

The design of this unit is said to give speed and convenience in milling, drilling and boring operations at any angle. All automatic feed controls are front-positioned for fast operation. *Rusnok Tool Works.*

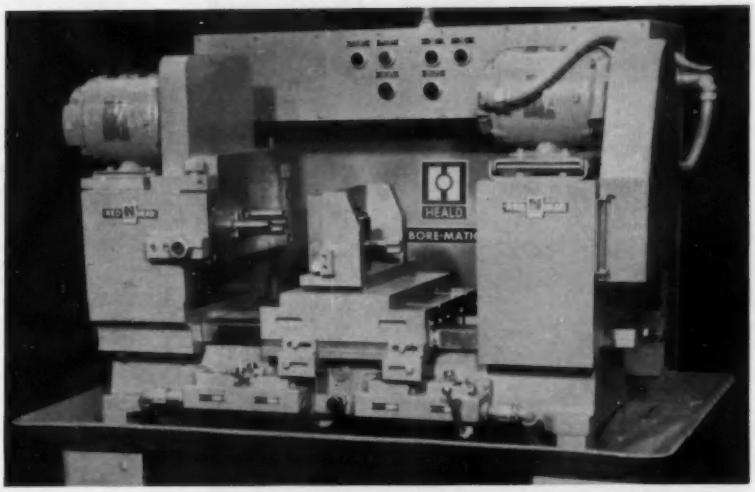
**Circle 49 on postcard for more data**

## Precision Finishing Machine Offers Range of Applications

DESIGNED around a number of standard, interchangeable units, a unitized precision finishing machine recently introduced and called the Model O Bore-Matic, may be set up as a dozen different basic machines with many combinations of standard tooling and fixture equipment. Work that can be done includes straight and taper boring, straight and taper turning, facing, chamfering, grooving diameters and faces, reaming, and, with special attachments, contour or spherical boring or turning and slot milling, singly or in combination. Either the work or the tools can be rotated, and different operations may be performed simultaneously or in sequence on one or more workpieces.

The machine will be made available in combinations ranging from a single-head unit with power-operated table, to a four-head double-end setup with cross slide. In its simplest form it consists of a precision-built base-way unit with hardened and ground box-type ways, hydraulically-operated table, cast iron base, hydraulic power unit and all necessary controls.

The multi-spindle Red Head boring head in the line is an entirely new unit which was developed for the machine. It is primarily for operations requiring multiple holes on close centers or in any position within the size limits of the spindle plate. Capable of boring on centers as close as ¾ in., the boring head is designed to use interchangeable spindle plates




*Heald Model O Bore-Matic finishing machine features a new multi-spindle boring head design and tooling for versatile application*

that can be bored to fit individual job requirements. For center distances closer than ¾-in., a cross slide is used for indexing to another cluster on the same plate. The device provides, in effect, a flexible cluster-head arrangement that can be custom-built to specific needs. A variety of spindles, ranging from ¾-in. miniature size up to 3½ in., can be used.

Boring head units, complete with motor drive, are mounted on the base ways at either the left- or right-hand end of the machine, or at both ends. They are available with one or two boring heads, or with the multi-spindle heads for simultaneous boring of multiple holes. The heads can be provided with hydraulic cross-feed units, and with air or hydraulically-operated chucks.

The table is supplied plain or with standard fixture; manual or hydraulic cross slides are obtainable. It is operated, through a rack and pinion, by a hydraulic cylinder at the rear of the machine where heat from the hydraulic fluid will not affect the machine's operation.

Capacity as measured by the distance from the top of the table to center line of the spindle is five inches with the table and four inches with cross slide. Distance between heads on a two-head unit is five inches; maximum table travel is nine inches, and maximum cross-slide travel is five inches. Feed ranges from ½ to 50 ipm, and rapid traverse rate is 15 fpm. Variations in center distances and heights can be specified where needed. Tolerances of 0.0002-in. can be held on regular production work.

Although the machine is normally furnished on a steel cabinet containing the hydraulic power unit and mounting the electrical control panel, it can also be supplied as a bench-type machine for mounting on any support of suitable strength and rigidity. In this case the hydraulic power unit and control panel can be separately mounted in any convenient location. The machine can also be operated from a central hydraulic system if desired. *The Heald Machine Co.*

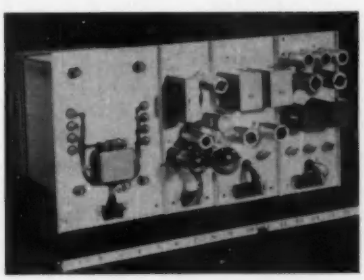
**Circle 51 on postcard for more data**

## Gaging Components

AUTOMATIC size control, automatic gaging, and automatic inspection and classifying may be added to new machines, or those in service, by means of standardized systems composed of combinations of seven components which have been developed, according to a recent announcement. Application of the systems to specific machines requires details of the machine requirements, from which the company develops the system specifications.

A typical application of a system to a through-feed centerless grinder includes a meter type size indicator, transducer head of comparator type for size control, servo motors, electronic classifier for operating reject gates and shut-off, and magnetic power amplifier which provides amplification to pre-amplifier output sufficient to drive servo motors. The seventh of the components is an electronic power supply, regulated. *Cargill Detroit Corp.*

**Circle 50 on postcard for more data**



*Cargill Detroit grouping of standardized components for combined size control and classifying operation*

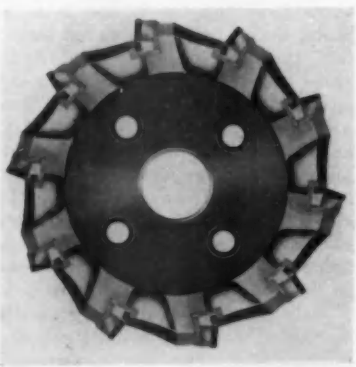
## Multi-Dimension Gage Checks Transmission Case


*Illustrated is a 21-column Precisionaire gage which is one of four now being used by a transmission maker to inspect 21 dimensions and conditions on an aluminum transmission case. It checks six internal diameters, two lengths, three parallelisms, four combination squareness and concentricities, five flatness, and one pan face to dowel location dimension, in a single handling of the part. Float positions in the instrument show whether each condition is within tolerance, or the amount of out-of-tolerance. The operator regularly checks between 50 and 55 parts per hour. (The Sheffield Corp.)*

Circle 52 on postcard for more data

## Carbide Face Mills

STANDARDIZED for machining light metal alloys such as aluminum and magnesium, a new series of inserted blade, carbide tipped face, milling cutters features high-feed milling of flat surfaces with good finish. Higher feed-per-tooth is said to be possible because the corner angle does all the cutting and chip thickness is always less than the feed-per-tooth. Impact between cutter and work is also said to be reduced because the inner end of the corner angle (the main cutting edge) enters the cut ahead of the outer end. Chips are curled upward and outward from the machined surface and away from the cutter itself, preventing scoring of the milled surface and clogging of chips in the cutter.



*Free Clear carbide face milling cutter.*

The cutters are standard in right-hand or left-hand cut in eight sizes of 8¼ to 18-in. OD, and in widths of 2¼ or 2½ in. Made-to-order sizes range as small as 4-in. OD in shell or shank integral type. Blades and wedges are stocked.

The cutter bodies are constructed so that radial serrations on the blade, and axial serrations on the wedge, produce a "crosslock" locking device when assembled in the body. This also permits blade adjustment for increased cutter diameters, in increments of 1/32-in. (per serration). No gages are said to be required to check uniformity of blade projection inasmuch as this is controlled by the serrations. *Goddard & Goddard Co.*

Circle 53 on postcard for more data

## Vacuum System Unit

INTENDED for laboratory, pilot plant and limited production use, a new vacuum system unit is now available that was designed primarily for coating of various materials with vaporized metals. It is also usable for degassing liquids, crystal pulling and growing, and melting metal samples. Known as the Type LC1-18A vacuum system, it features a high-capacity pumping system which reduces pumping time, and offers a line of standardized accessories for added versatility.

The pumping system includes a three-stage oil diffusion pump and affords a choice of 13, 15, 27, or 130-cfm mechanical pumps for roughing and backing. These pumps are operated by circuit breakers and are interlocked to prevent improper sequencing. Pump-down time with a clean, dry system is five minutes to 0.5 micron Hg, with an ultimate pressure of $3 \times 10^{-5}$ mm Hg. With a fractionating oil diffusion pump substituted for the three-stage pump, an ultimate pressure of $3 \times 10^{-6}$ mm Hg can be reached. Pressures in the work chamber and fore-pressure lines are measured by new discharge and Pirani gages from 2 mm to $1 \times 10^{-7}$ mm Hg. A leak detection feature of this Pirani utilizes its sensitivity to detect leaks from 1 micron to 10 mm Hg pressure.

An 18- by 30-in. Pyrex bell jar is the work chamber. It seats on a baseplate which has holes for vacuum-gage sensing tubes, filament heating electrodes, and optional accessories. The system is equipped with roughing, backing, and air inlet valves, in addition to a water-cooled combination valve and baffle located above the diffusion pump to minimize backstreaming of oil vapors. All controls are cabinet-mounted and easily accessible. The LC1-18A with a 13-cfm mechanical pump is 114 in. high, 39 in. wide, 54 in. deep, and weighs 970 lb. *Rochester Div., Consolidated Electrodynamics Corp.*

Circle 54 on postcard for more data

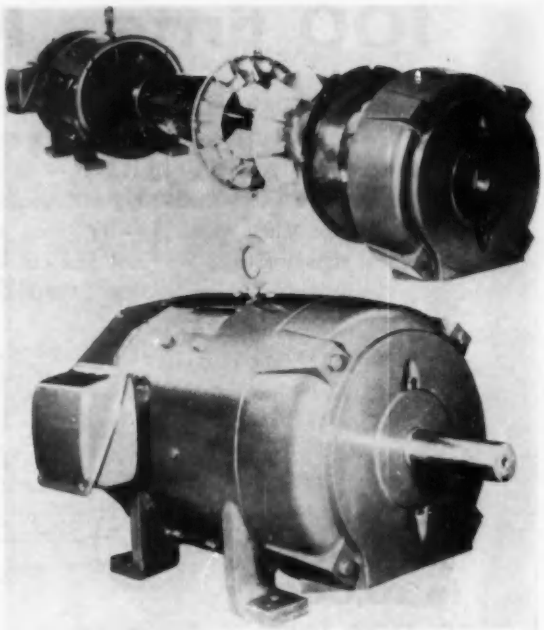
*Consolidated Electrodynamics Type LC1-18A vacuum system unit*

## New Line of Industrial D-C Motors and Generators

SPANNING motor ratings from 1 to 150 hp and generator ratings from ¾ to 100 kw, a new line of industrial d-c motors and generators contains features for improved performance and dependability from standard machines. Known as the Life-Line H series, they have dripproof enclosures and bear NEMA Class B ratings.

Among the features said to be available for the first time in standard units, are a high-temperature silicon insulation used in machines rated to operate within Class B temperatures; a controlled ventilation system that draws air from the drive end, distributes flow positively throughout the machine, and expels it at the commutator end; and a new housing construction which enables the dripproof units to serve many applications which ordinarily require splashproof equipment. In addition, as the result of a marked decrease in armature inertia and improved commutation, the motors are capable of faster dynamic response. Armature inertia has been decreased by as much as 55 per cent in some ratings, and commutating ability increased by 35 per cent.

By combining a high-temperature insulation system with a complement of copper and iron equal to that of conventional Class B machines, motor insulation life is indicated by accelerated life tests to have been increased at least 10 times. Normally, insulation will thus not be a limiting factor on motor and generator life, and it is equal to many emergency overloads, abnormal ambients, or rigorous duty cycles. *Westinghouse Electric Corp.*



*Westinghouse Life-Line H d-c motors and generators attain reliability and dynamic response with high-temperature silicone insulation, a new ventilating system, and reductions in armature inertia up to 55 per cent over previous values. The ventilating system reverses traditional direction of air flow. By drawing in air at the drive end, distributing it positively between fields and armature, and discharging at the commutator end, the system is said to achieve maximum use of internal fan action, expulsion of brush dust, and more effective cooling*

Circle 55 on postcard for more data

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## Safety Control

IN protecting personnel operating machinery, an electronic safety control unit now being offered sets up a capacitance field around the danger area so that a person, or person's hand, in this area is instantly recognized and an electrical signal sent to the machine's breaking mechanism.

The size and shape of the safety field are determined by the positioning of the sensing element and control adjustments. In addition, sensing elements of differing sizes and shapes may be used to achieve the setup of a particular field desired to protect a specific area. The machine will not run with a person in the field unless, as is sometimes desired, it is cammed out on the upstroke to increase production.

Failure of any electronic component also causes the machine to stop. Tubes are accessible for checking, and the inner chassis is removable. The cabinet is shock-mounted and gasketed, and has a lock and key. Installation may be made by plant personnel, simple control adjustments, meter, and indicator lights facilitating setup. Model designation is SCI 500-1A electronic safety control. *Security Controls, Inc.*

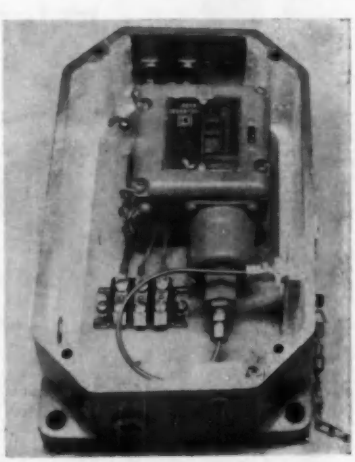
Circle 56 on postcard for more data

## Protective Device

INTRODUCED to provide protection against automatic lubrication failure, a package unit called Cyclesafe automatically stops machines when the lubrication pressure drops below a predetermined setting. It is said to be unique in that the machine is allowed to complete its working cycle before stopping, thereby preventing tool, cutter, die or knife damage. The machine cannot then be re-started until the failure has been corrected and pressure restored.

The unit contains standard electrical connections conforming to JIC and MNTBA standards, which can easily be tied into existing circuits. It is applicable to various types of machinery; and is stated to be completely tamper-proof. *Seneca Falls Machine Co.*

Circle 57 on postcard for more data

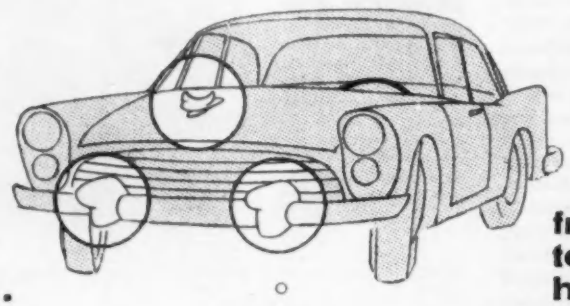


*Cyclesafe protective unit for forced feed lubrication systems*

# HY-PRO specialists will show you how a little difference in design can deliver

# 100 times longer tap life

The jobs where tap life can be increased a hundredfold are obviously exceptional, but it *can* happen, as these cases prove, even in the cost-wise automobile industry. That's why it pays to question tap costs on any job. Job analysis by HY-PRO specialists *regularly* leads to savings as high as 50% — with special taps when required — but often with a simple switch to the right style of standard taps. Why not find out if your tap costs are low as they can be? It costs nothing to consult the HY-PRO specialists.



## from 100 to 10,000 holes per tap...

The standard spiral point tap formerly used for tapping an automobile bumper bracket lasted for 100 holes or less, due to breakage. The cause was misalignment which could not be corrected without prohibitive expense for jigs, and for special controls in preceding operations. HY-PRO specialists designed a no-flute, 3-spiral groove tap with special heat-treatment which boosted production to 10,000 holes per tap — with no change in job conditions. Result . . .

**98% SAVINGS in tap cost**

## from 25 to 10,000 holes per tap...

In a tapping operation on a die cast automobile ornament, the standard 3-flute tap being used broke after an average run of 25 holes. The cause was spalling and binding of the relatively soft alloy around the tap. HY-PRO specialists recommended an oversize 3-flute plug point tap with minor flute modifications. Binding was eliminated, and clean cut threads permitted easier assembly. Production was increased to 10,000 holes per tap. Result . . .

**99% SAVINGS in tap cost**

HY-PRO

REG. U. S. PAT. OFF.

*The Tap Engineering Specialists*

### Why "special" tap development brings you better "standards"

Even though you never need "specials", you benefit by HY-PRO leadership in special tap design. The intensive research and testing involved is all reflected in constant improvement of HY-PRO standard taps. HY-PRO specialists can often point out opportunities for substantial savings, even in tapping operations you've considered satisfactory. For information, write: Dept. A.

**ASK FOR STOCK LIST OF SPECIAL TAPS AVAILABLE FOR IMMEDIATE DELIVERY**

**CALL YOUR LOCAL HY-PRO DISTRIBUTOR FOR STANDARD TAPS FROM STOCK**
**HY-PRO TOOL COMPANY • NEW BEDFORD, MASS., U.S.A.**

# Free INFORMATION SERVICE

**Use either of these postcards for Free Literature listed below, or for more information on New Production Equipment and New Products described in this issue.**

USE THIS POSTCARD

## FREE LITERATURE

### Pearlitic Malleable 1

The metallurgical characteristics, properties, hardenability, machinability, and processing of pearlitic malleable iron are contained in a 24-page bulletin which thoroughly discusses and describes this material. *Albion Malleable Iron Co.*

### Silicone Fluids 2

To aid designers in evaluating various silicone fluids for specific applications, a reference brochure is available describing the characteristics of all leading fluids now commercially available. Four pages, Code 3-106. *Dow Corning Corp.*

### Bearing Metal 3

Babbitt metal made by the Glyco process, which is said to offer improved physical characteristics, is the subject of four-page bulletin 80-5. *Joseph T. Ryerson & Son, Inc.*

### Carbide Tool Grinder 4

Bulletin 53, eight pages, describes a grinder for carbide tools and shows its various applications. *E. F. Hager & Son.*

### Air Brake Equipment 5

Air brakes and control equipment for mobile and industrial applications are covered in 28-page Catalog KU-201B, including air-over-hydraulic systems and diagrams of installations. *Wagner Electric Corp.*

### Die-Form Process 6

Described in a four-page folder is the Die-Form method for the cold reduction of steel bars into multi-diameter shaft blanks ready for finish turning or grinding. *Republic Steel Corp.*

### Spray Machines 7

Automatic transverse spray finishing machines of four types are presented in 12-page catalog 1-8010. *The DeVilbiss Co.*

### Aircraft Fasteners 8

Engineering data on SAL and SLS light-weight Huckbolt fasteners for aircraft applications are given in 14-page catalog 8-350, together with descriptions of pneumatic and hydraulic driving tools. *Huck Manufacturing Co.*

### Heat Treating 9

Also included in a 32-page booklet presenting facilities for heat treating are a glossary of heat treating terms and useful tables on weights of bars, weights of basic materials, and hardness conversion table. *Pittsburgh Commercial Heat Treating Co.*

### Vinyl Hose 10

Industrial vinyl plastic hose, Type H-52, is detailed in eight-page catalog just released. *Hofmann Engineering Co.*

*(Please turn page)*



VOID After July 1, 1957 5/1/57

**Circle code numbers below for Free Literature, New Plant Equipment, or New Product Information**

| | | | | | | | | | | | | | | | | | | | |
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| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |

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ADDRESS ..... (CITY) (ZONE) (STATE)
(No. & STREET)

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Permit No. 36
(Sec. 34.9 P.L.&R.)
New York, N. Y.

BUSINESS REPLY CARD
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POSTAGE WILL BE PAID BY

**AUTOMOTIVE INDUSTRIES**
P. O. Box 66,
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Readers Service Dept.

## Metalworking Data 11

"Computations for Metal Working in Presses" is the title of 50-page bulletin 38 which includes data for computing pressure and sustained work capacity of presses, and formulae and charts on blanking and shearing, drawing and reducing, coining, sizing and forging, and extrusion. *E. W. Bliss Co.*

## Turret Tool Posts 12

Turret tool posts with new clamping type handle designed for positive locking to withstand vibration of interrupted feeds or fast feeds and speeds are described in eight-page bulletin 19-T. *McCrosky Tool Corp.*

## Silicones 13

Designated CDS-97, an eight-page catalog discusses more than 115 applications for silicones, including uses in rubber products, electrical insulation, water repellents, textile finishes, lubricants, release and anti-foam agents. *Silicone Products Dept., General Electric Co.*

## Torch Cutting Unit 14

The advantages and applications of the No. 4 Monograph portable shape-cutting machine are listed in eight-page booklet ADC 660B. *Air Reduction Co., Inc.*

## Stainless Machining 15

A pocket-size slide chart contains information on how to machine stainless steels in a line, including data on turning, drilling, threading, milling and reaming operations. *The Carpenter Steel Co.*

USE THIS POSTCARD

## Mechanical Packings 16

Technical details on mechanical packings fabricated from Teflon are provided in eight-page brochure P-325. Contents include 15 types of braided construction, six types of molded construction, cup and cone rings, and combination sets for corrosive service. *Crane Packing Co.*

## Resistance Welders 17

Thirty-two multi-spot and projection resistance welding machines, and their end products and production rates, are described in 10-page special machine bulletin 8-413. *The Taylor-Winfield Corp.*

## V-Belts 18

Tips on how to obtain longer V-belt life, increase drive efficiency and assure continuous production are contained in bulletin 20X6234C, 12 pages. *Allis-Chalmers Manufacturing Co.*

## Lubrication Fittings 19

For the convenience of design, lubrication and product engineers, a 31-page catalog, form 38-23, on lubrication fittings of various types, has been produced by *Alemite Div., Stewart-Warner Corp.*

## Honing 20

The subject of honing is fully discussed in a 44-page handbook, which is complete with charts for proper speed selection to obtain desired finishes, and includes equipment for honing and data on abrasives. *Barnes Drill Co.*

## Conveyor Systems 21

In-floor and overhead conveyor systems are covered in comprehensive Catalog 157, 42 pages, which comprises mechanical details, installation data and typical applications. *Jervis B. Webb Co.*

## Aluminum Extrusions

A 130-page illustrated handbook on the use of aluminum extrusions and the properties of materials, is available by request on company letterhead from *Aluminum Div., Bridgeport Brass Co., Bridgeport 2, Conn.*

## Control Components

Seven electro-magnetic control catalogs have recently been issued covering, respectively, automatic transfer switches, remote control switches, contactors, relays, solenoids, electric plant controls, and combined catalog of the complete series. Request on company letterhead of *Automatic Switch Co., Florham Park, N. J.*



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VOID After July 1, 1957

5/1/57

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| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |

NAME ..... TITLE .....
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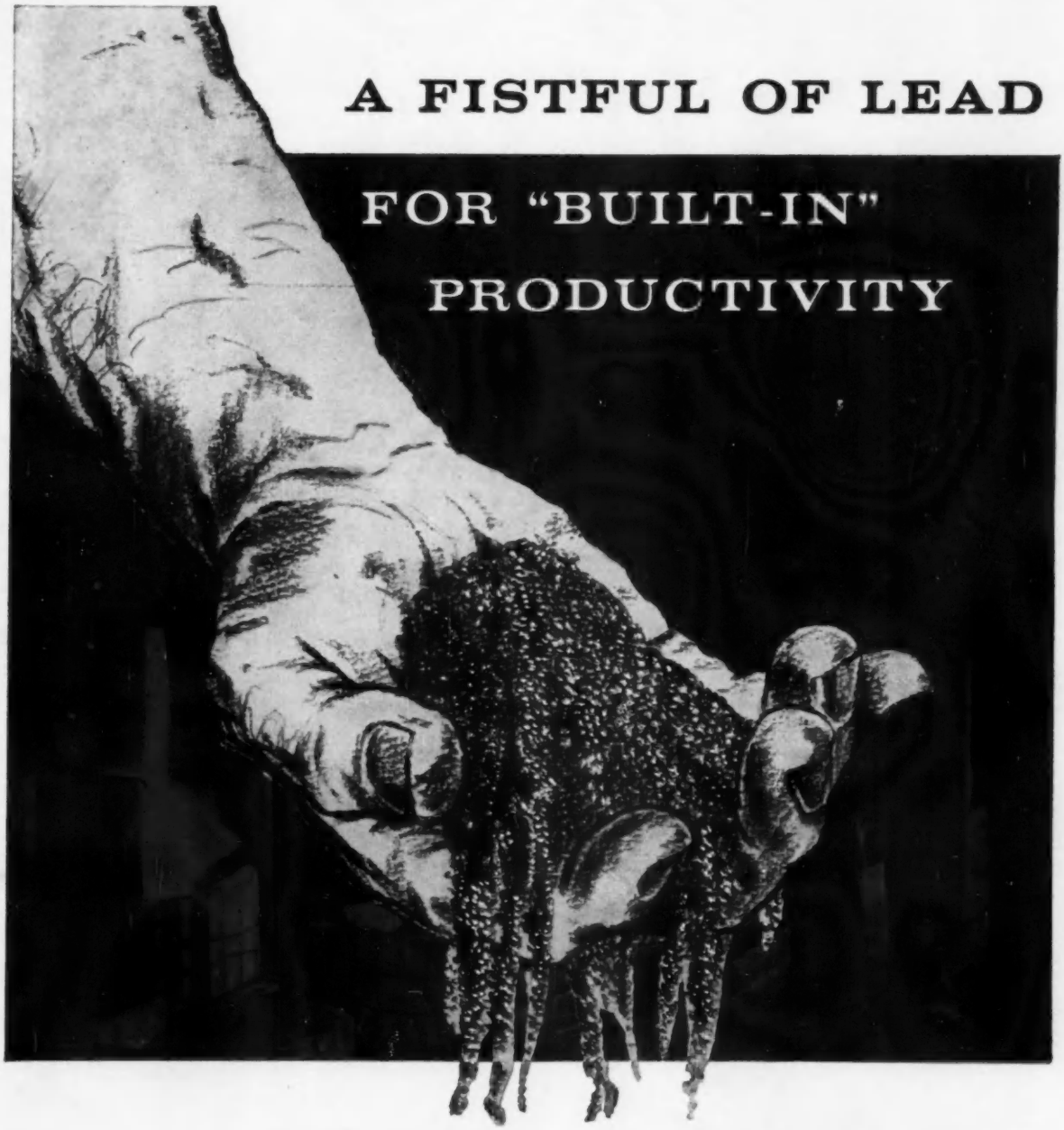
# A FISTFUL OF LEAD

## FOR "BUILT-IN" PRODUCTIVITY



Controlled additions of lead, introduced when the ingots are teemed, produce steel with vastly superior machining qualities compared to same steel unleaded. Leaded alloy and carbon are freer machining, permit faster feeds and speeds and greatly increase tool life. They cut clean and with a fine finish which frequently eliminates the final machining operation. These better machining qualities add up to a kind of "built-in" productivity that can mean substantial production line savings for you.

If you would like to see for yourself what "built-in" productivity can mean in your operation, ask us to lead half of your next Aristoloy order. Our field metallurgist is also at your disposal—ready to work with you in selecting the best leaded grade for the job.

For complete information, call the Copperweld office in your nearest major city, or write direct.

ARISTOLOY STEELS

**COPPERWELD STEEL COMPANY**

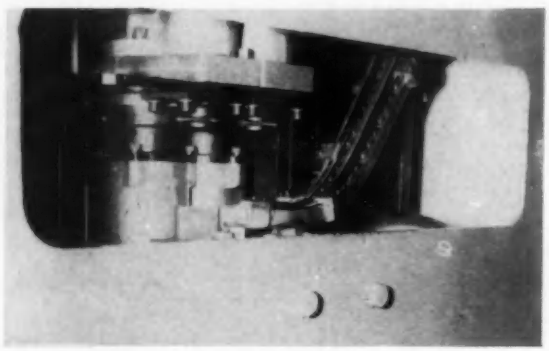
**Steel Division • Warren, Ohio**

EXPORT: Copperweld Steel International Co., 225 Broadway, New York 7, N.Y.

# News of the MACHINERY INDUSTRIES

By Thomas MacNew

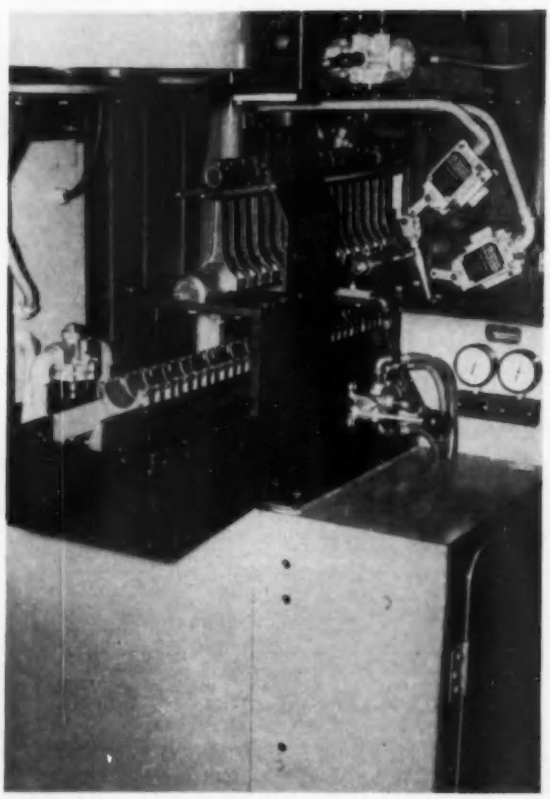
## Special Machine Assembles Bolts in Connecting Rods, Installs Caps, Puts Nuts on Bolts, and Tightens Nuts to Proper Torque



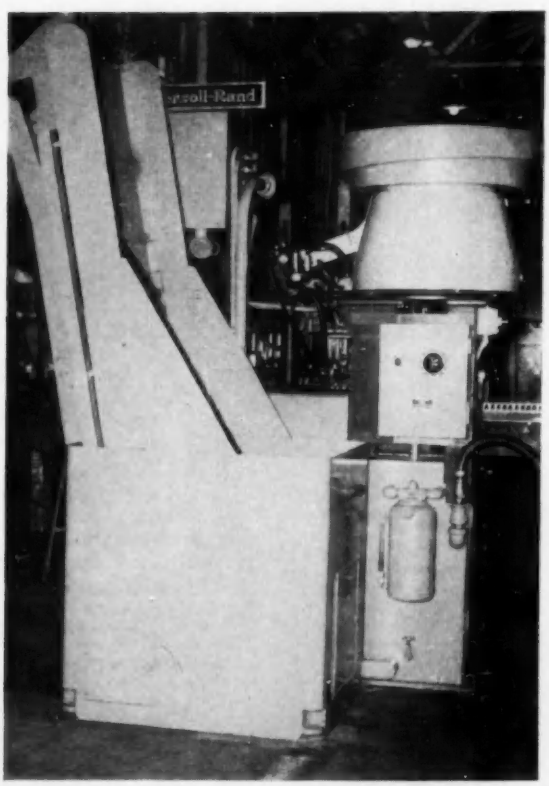
*Close-up of nut feeding station*

INGERSOLL-RAND has developed an air powered, elec-lectrically-controlled assembly machine for putting caps on connecting rods at a 700 per hour clip. The machine, unveiled last month at a press conference in the I-R Athens, Pa., plant, will be shipped to Ford Motor Co.

The rod assembly consists of six parts—the rod, two bolts, two nuts, and the cap. These are handled in a straight line type transfer machine with automatic feeds for the bolts and nuts. In the machine demonstrated, rods and caps were manually loaded into a magazine, but the unit could easily be adapted



*General view of I-R machine from the loading end*




*Side view showing elevator nut feeder and bolt feeder*

to automated loading of the component parts.

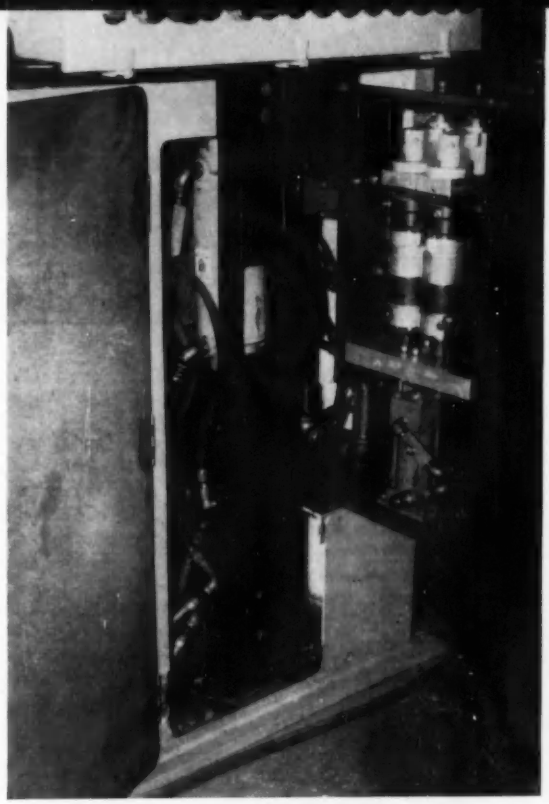
The machine:

(1) Orients and feeds the bolts
(2) Presses in the bolts
(3) Places the cap in position
(4) Feeds the nuts
(5) Torques the nuts
(6) Ejects the finished assembly

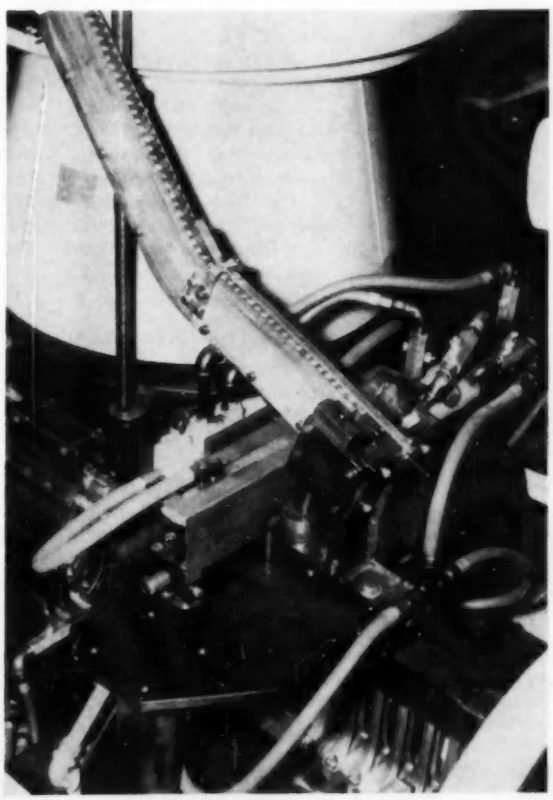
The loading end of the machine consists of a lift-and-carry conveyor that brings the rods and caps forward until they reach the positive index mechanism. The positive index mechanism consists of transfer fingers swinging into engagement with rods, moving rods forward to index with stations, after which the fingers swing out, disengaging rods, and return to start position. The lift-and-carry motion also brings the caps forward until they are automatically engaged with the rod.

At the first station during the positive indexing of the rod, bolts are inserted and given a preliminary light press to maintain the orientation of the bolt head. At the second station, bolts are forced home with a final heavy press. Simultaneously, at this

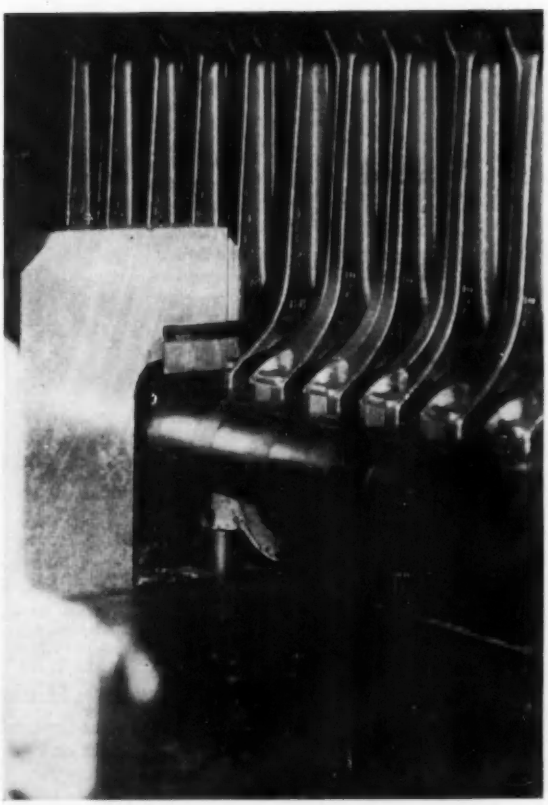
(*Turn to page* 114, *please*)



***Entire nut running station can be rolled out for servicing. Heavy pressing station in left can also be rolled out***



***Top view showing bolt feeder and orienting device***



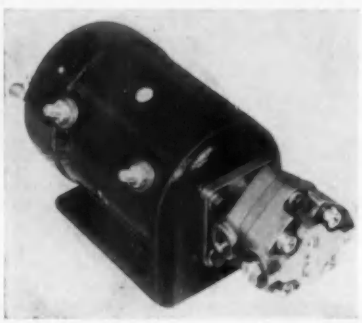
***Cap is applied to rod in heavy press***

# NEW PRODUCTS AUTOMOTIVE-AVIATION

*FOR ADDITIONAL INFORMATION, please use reply card on PAGE 89*

## Motor-Pump Unit

Designed specifically for 6 and 12-v battery-operated applications such as vehicles, lift trucks, snow plows, tail gate lifts, and graders, a multi-purpose motor-pump combination measures only 12¾ in. in length. Direct



coupling eliminates alignment problems between pump and motor and the need for an external flexible coupling. Pumps with greater or smaller capacities can be substituted without changing the mounting. Nylon check and relief valves are used for long leakproof operation. The motor is a specially constructed heavy-duty d-c series unit designed for high starting torque. The compact combination includes a four-bolt foot mounting integral with the motor. *Webster Electric Co.*

Circle 60 on postcard for more data

## Safety Panels

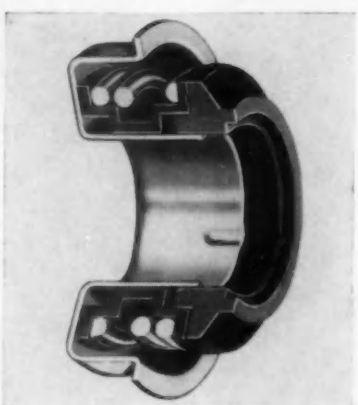
Safety panels that automatically shut off engines should oil pressure drop to a dangerously low level or water temperatures rise to a dangerously high point, are being offered in a new line for continuous protection and automatic operation of unattended or remotely-controlled engines. Available for both battery and magneto type ignition systems, as well as Diesels, these "expandable" panels include pre-cut holes for the insertion of the company's tachometer, Hobbs hour-meter or other instruments or gages as needed to facilitate clocked maintenance or inspection. The minimum oil pressure level is factory-set at 5 lb, and water at 25 lb and 205 F; but all may be adjusted to fit a particular need. The gage equipment can be used on 6, 12, 24 or 32-v circuits.

Also available is a compact aluminum panel with holes for two safety gages, a starter switch and choke control. *Stewart-Warner Corp.*

Circle 61 on postcard for more data

## Water Pump Seal

For sealing water pumps and other equipment handling fluids a device has been introduced which consists of a machine-lapped sealing washer, a compression spring and a synthetic rubber boot, all contained in a brass cartridge. The unit is designed to adjust automatically to compensate



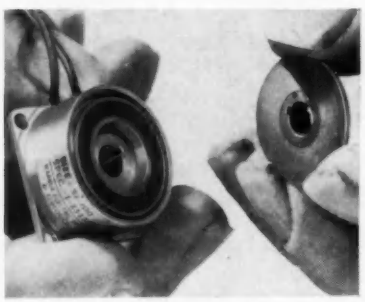
for wear or shaft movement, and comes in a single assembly for easy installation. *Brummer Seal Co.*

Circle 62 on postcard for more data

## Miniature Clutch

For low torque drives of instruments and miniaturized control mechanisms, an electro-magnetically operated miniature clutch has been introduced. Model designation is SF-100. The unit gives instantaneous, positive engagement and release of loads up to two lb-in. (static torque rating). Axial length of the clutch is only ⅞ in. and diameter is 1⅛ in.

No slip rings or brushes are re-



quired since the field is connected through pigtail leads to a 28 or 90-v d-c source. Torque is transmitted through the rotor to the armature which may be keyed to the driving or driven member. Power required is six watts maximum. Mounting requirements for the flange-mounted unit are simple, consisting of four holes for ⅛-in. capscrews equally spaced on a 1-5/16-in. bolt circle. *Warner Electric Brake & Clutch Co.*

Circle 63 on postcard for more data

## Top Material

Being marketed is a new convertible top material, coated with Hypalon synthetic rubber, which is said to offer superior qualities in ease of installation, appearance, cleanability, and life. The material is soft and pliable, and doesn't get stiff in cold weather. Tearing is no problem and the top may be installed to the car frame by staples. The synthetic rubber cleans easily with soap and water. It is stated that prolonged exposure to weather in Florida showed negligible effects on the material's properties or appearance. *E. I. du Pont de Nemours & Co.*

Circle 64 on postcard for more data

Continued on Page 96

For

Best Performance in

# AMERICAN MOTORS ENGINES

AMERICAN MOTORS... one of the leading engine manufacturers using Perfect Circle chrome rings for both original equipment and replacement service requirements

# PERFECT CIRCLE

## 2-in-1 CHROME PISTON RINGS... *the standard of comparison*

## Printed-Circuit Method

Etching is eliminated in a method recently developed for producing printed circuits by the use of molding techniques. In addition, the method permits the molding-in of three-dimensional effects at the same time the circuit itself is being produced. The basis of the process is a phenolic impregnated cellulose sheet material, produced by the company, that meets specifications up to NEMA standards for XXXP laminates when properly molded.

Besides facilitating production, the method is said to provide design latitude. Hole concentration can be twice that of punched XXXP parts. Molding also allows holes to be tapered or stepped in depth. Supplied uncured, the materias can be moded into three-

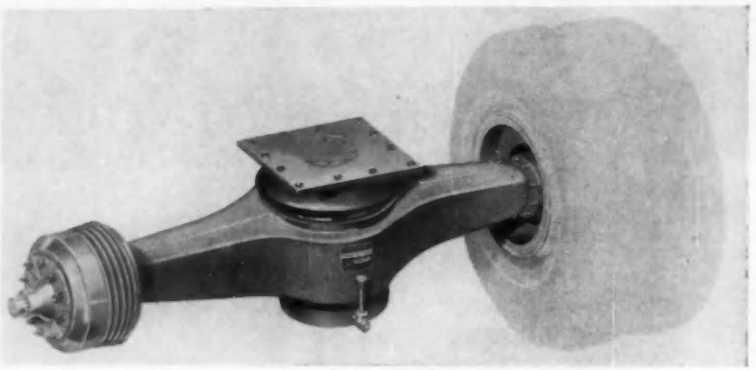
dimensional shapes, with holes for component lead insertion.

Several processes have been adapted by the company for producing circuits to meet various requirements. Demonstrated recently was the die stamping process in which an adhesive-backed continuous copper strip is stamped into the molding board. The board serves as the cutting edge and female die. The punch impresses the copper below the surface of the board, adhering those parts which will form the circuit. Excess copper is stripped away prior to molding. Standard compression molding techniques are used to complete the circuit.

Illustrated is a molded circuit for an automotive part. From top to bottom is shown the design in the copper stamped in the molding board, the pattern on the molding board with excess copper stripped away, and the completed circuit. A cover sheet protects the circuit, except for contact points, from short-circuiting.

Present marketing plans call for the licensing of companies producing printed circuits for their own use, as well as the supply of circuits by a division of the company. *Rogers Corp.*

Circle 65 on postcard for more data



*A. O. Smith fifth wheel tandem trailer suspension*

## Trailer Integrated Axle and Fifth Wheel

Designed for use as the front suspension on the rear trailer of a truck train, a new integrated axle and fifth wheel unit includes springing by means of rubber doughnuts floating in a sealed oil bath that are contained inside the axle housing. Stated advantages of the design are reduced weight (and increased payload), lower maintenance, better driver control, and improved riding qualities (particularly under light loads).

The integral axle fifth wheel consists of two assemblies: the stabilizer assembly fastened to the trailer frame, and the axle assembly. Housed inside the axle are five pairs of synthetic rubber cushion rings, bonded to steel divider plates, that carry the vertical loads and shocks. In addition, Neoprene O-rings, in a unique arrangement, absorb rebound shock. This assembly, floating in an oil bath, is cased with a protective cover, enveloped by a permanently-bonded synthetic rubber cushion-jacket. A center pin links the two assemblies together, providing the axis for turning. Weight of the complete unit is about 550 lb. *A. O. Smith Corp.*

Circle 66 on postcard for more data

## Metal Primers

Some new latex paint formulations recently developed are said to have attractive properties as metal primers. A leading motor car producer already has announced plans to use latex paint in a dip-tank operation.

Being water soluble, the latex paints are easy to handle. They do not require drying ovens since they are air-drying and set rapidly. The absence of organic solvents lowers cost and eliminates recovery systems. Working conditions are better and insurance rates are lower due to the absence of possible toxic effects and fire hazards.

According to the company, these primers have exceptional adhesion and resistance to corrosion. *The Dow Chemical Co.*

Circle 67 on postcard for more data

## Oil Additives

The development of a new series of lubricating oil additives for improving low as well as high temperature performance was announced recently. The materials are classified as oil-soluble, high-molecular-weight polymers, and are of petroleum origin. They decrease the tendency of the oil to thin out in hot spots of the engine; and by lowering the congealing point, increase flowability of the oil at sub-zero temperatures. Tests conducted by the company showed that oil containing the additive flowed readily at temperatures of 30 to 50 deg below zero.

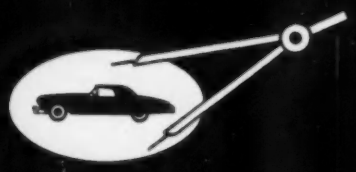
The additives will be marketed to lubricating oil manufacturers under the name Omavis. *Olin Mathieson Chemical Corp.*

Circle 68 on postcard for more data

USING

# DU PONT ELASTOMERS

neoprene · Hypalon®



in design

## Convertible tops coated with Du Pont Hypalon® resist sunlight, weathering, discoloration, cracking

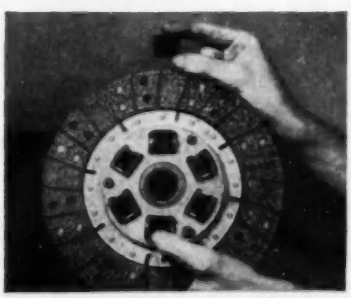
14 YEARS' EXPERIENCE PROVES

### NEOPRENE blocks promote clutch-plate efficiency

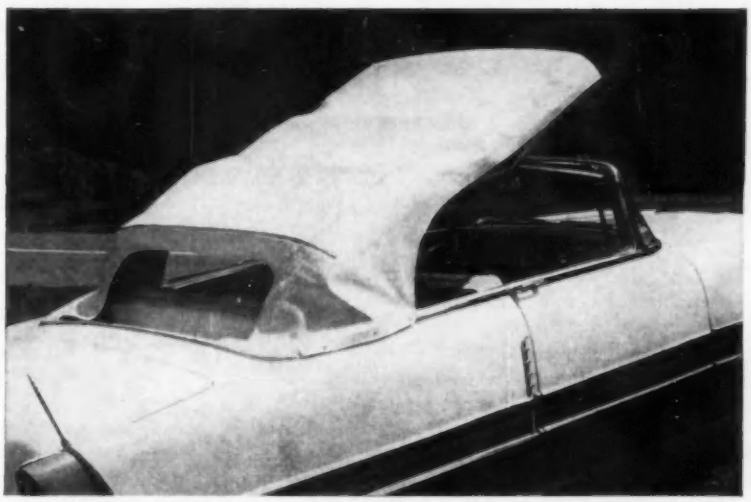
For over fourteen years, taxi and truck fleets have been road-testing a new type of replacement clutch plate—one in which resilient blocks of neoprene have replaced conventional metal springs. Results indicate a vast improvement in over-all clutch performance, and maintenance costs have been reduced nearly 50%.

In operation, the neoprene blocks smoothly transmit the torsional force of the clutch. They retain their elasticity for longer than the life of the clutch facing, despite constant flexing and exposure to heat and oil. And cab drivers report there's less lost motion in the drive line—no clutch "chatter"; no trouble with springs breaking or coming loose. The result is more efficient clutch operation and reduced abuse of clutch facings.

It's an outstanding example of design improvement made possible with neoprene, Du Pont's synthetic rubber. Why not see how you can use Du Pont's neoprene to help solve *your* problems? Just clip the coupon for full information.



Small as they are, these neoprene blocks do a big job as replacements for conventional metal springs. Clutch operation is smoother, quieter, more efficient.



Coating of **HYPALON** stays flexible in cold weather, washes easily with soap and water.

**Longer service life.** There are many reasons for coating convertible tops with HYPALON, Du Pont's new synthetic rubber. HYPALON coatings stay flexible at low temperatures, and they will not crack after prolonged exposure to all kinds of weather. They possess exceptional resistance to sunlight. And they can be compounded in an unlimited range of light-stable colors.

**Soap-and-water maintenance.** HYPALON coatings also have superior resistance to soiling. They are inherently resilient and do not develop a sticky surface to hold dirt and dust. If HYPALON coatings do become dirty, they can be washed easily with soap and water with no harmful effects.

**Manufacturing Advantage.** Many other materials wrinkle and crease permanently when folded, but HYPALON synthetic rubber coatings return more readily to their original smooth surface. The HYPALON-coated convertible top also tailors and trims better in manufacture.

**Investigate HYPALON.** HYPALON is being used by the automotive industry in other items such as spark-plug boots, door stripping and white side-walled tires. Its exceptionally high resistance to ozone, heat, chemicals and outdoor exposure offers still more automotive design possibilities. Just clip the coupon below for more information on the properties of HYPALON.

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# Observations

By Joseph Geschelin

## Shorter Hours

Despite the present high labor rates prevailing in the industry, the CIO now threatens to seek a shorter work week with another boost in rates, presumably to assure the same take-home pay. Undoubtedly this is done to combat the rise of automation. And just as surely it indicates that the CIO has misread the implications of automation. Automation has not created unemployment. Nor has automation materially improved productivity per worker when considered overall. This is true because automation cannot be applied across the board for all production activity. The real purpose of automation is to attempt to hold the line on overall cost despite increased labor rates. The public already is resisting the higher price tags on 1957 cars. What will happen if rates increase still further? Moreover, the economy of automation depends upon intensive use of this extremely expensive equipment. A 20 per cent reduction in working hours may well ruin the economy of a real automation setup by increasing amortization cost. Apparently the unions are more interested in punitive measures than in a realistic appraisal of their effects upon the industry, the economy, and workers' job security.

## Cultural Stream

Some time ago one of our friends among noted industrial designers inquired whether the styling of motor cars in any year was the result of "something in the air" that stimulates the entire group. We have just read some stimulating essays in the "World of Mathematics" indicating that the leading philosophers were discussing the same phenomenon some 200 years ago. The conclusion appears to be that new trends of thought whether in mathematics or the arts and the sciences are products of contemporary streams of thought. It is in the air. We live in a particular culture and are imbued with the entire stimulus of that culture. Advances in thinking are inevitable. And it is common for many people to make the same discovery or forward step. If a Newton or an Einstein or a Harley Earl does not make it first, some contemporary doubtless will. That has been the experience of the ages.

## Small Cars

The European invasion of the domestic market has assumed large proportions during the past few years. In numbers this market would help the independents materially, if they were able to preempt it. What are the reasons for the intensified demand for foreign cars? Our own opinion is that foremost is the matter of snob appeal. Apparently there are many thousands of motor car owners who like the idea of a European car. Mainly it's different. Secondly, you have the appeal of economy. On the other hand, we find that the European cars with their complete lack of acceleration are fast becoming a traffic headache in congested centers. Take a look at North Woodward in Detroit during the traffic hours if you wish to confirm our impression. Finally, does this trend indicate that our drivers want small, low-priced cars? Perhaps it is time to consider this question. Certainly current engines have grown big physically and big in output. The trouble is that with the high labor rates prevailing in the USA it is doubtful whether a small car could be built much cheaper than a big one. That is indeed a major problem.

## Additive Problems

Over the years the changing requirements for engine lubricants have been met by improvements in the base materials together with an extensive use of additives of various kinds. March 1957 *Lubrication* (The Texas Co.) points out the serious problems confronting the chemists in the utilization of additives. It must be realized that these compounds are chemically active; they may react upon each other and may react with the base lubricant. Consequently, the range of additive compounds must be constantly sifted to select those that are compatible. It is not a matter of simply adding everything that might do some good in an engine. As in other matters concerned with lubricants, it appears that the best assurance of adequate quality still resides in the experience and reputation of the supplier.

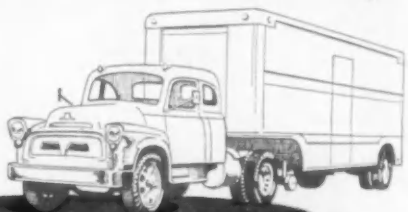
## Foreign Cars

Now that many foreign cars are selling to customers in the USA in fairly large volume—by comparison with European sales—it is hinted that some of the manufacturers are beginning to think in terms of styling changes. For many European producers this will be a radical step indeed. One of the things that sells cars in Europe is longevity. Some makes — Volkswagen is one of them — have gained the reputation of lasting 10 to 12 years in the hands of the first owner. Hence styling is no factor at all. In the lush USA market, styling will be im-

(*Turn to page* 118, *please*)

*Rapidly becoming the*

# Standard of the Automotive Industry



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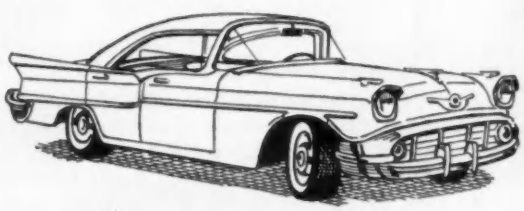

**Sterling's revolutionary *Conformatic* piston already has been accepted and is now being used in a number of America's finest and most popular passenger cars.**


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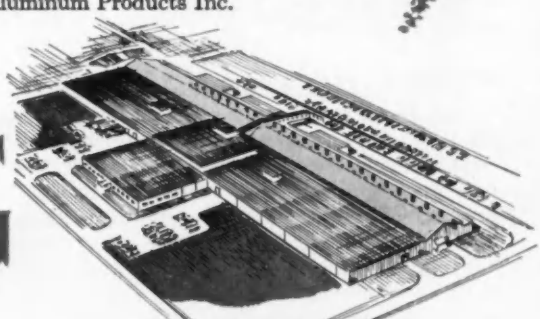
prevents frictional horsepower loss, reduces oil consumption to an absolute minimum, and prolongs engine life up to 400%. *Intra-Cast* and *Conformatic* are registered trade names of STERLING Aluminum Products Inc.



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# METALS

*Decline in Steel Production Reflects Lower Automotive Needs. Copper Price Stabilizes, While Brass Demand Continues Slow*

*By William F. Boericke*

## Steel Operating Rate Falls

Optimistic statements by some steel executives on the operating rates of their mills contrast sharply with the decline reported in mid-April for the steel industry as a whole, which had fallen to 91 per cent of capacity. At this rate, the indicated weekly steel melt was 2328 million net tons, a low since August, 1956.

The industry trade journal—Chilton's *The Iron Age*—stated that there may be production declines extending into late May. However, overall order volume now suggests that the mills may be able to stabilize ingot output by late May or early June. Production had started to decline in mid-February, when it was 98 per cent of capacity with a weekly output of 2.5 million tons.

It now appears evident that the big steel producers able to vary their product mix with comparative ease are faring better than their smaller competitors, especially those dependent on sheet and strip orders from Detroit. The drop in automotive steel buying has been the biggest disappointment of the year to date.

Automobile manufacturers are still highly inventory conscious and appear to be trying to match orders for steel against their own shipments without attempting to rebuild their inventories. Steel men are by no means so sure that Detroit will increase its buying rate until Fall.

## Weakness In Sheet and Strip

It is thought that basic steel prices will be advanced in July by perhaps $5 a ton under the terms of an automatic wage boost guaranteed in the three-year wage contract of last August. However, such a prospect has by no means panicked consumers to get in under the wire.

Prices have already advanced an average of about $4 a ton under the disguise of extra charges. No doubt the acknowledged weakness in sheet and strip products, some of which are being offered by brokers at less than posted mill prices, has thus far served to calm any urge to stock up in advance. In short, while a price advance may be justified, it may prove difficult to obtain.

Some further evidence of this is seen in the protest of the can makers against the boost in tin plate price of $7.70 a ton effective April 30. They assert that the increase cannot be absorbed in their overall operating costs and any attempt to pass on the costs would bring other alternate container-making materials into sharp competition with tin plate.

## Structurals, Plate, Still In Good Demand

Exceptions to the foregoing are structurals and plate, still the mainstay of the market, and still in high demand. But even here the scarcity is less pronounced, and premium prices have all but disappeared. Some mills have been able to turn their facilities over to making light plate instead of sheet. This, in turn, has permitted a greater effort to turn out heavier products.

Demand for structurals is strong and could be stronger were it not for the shortage of engineers. Some disappointment is expressed over the slow progress being made in the roadbuilding program, and some weakness has recently shown up in stainless steel, which again can be traced to slower demand from the automobile industry.

## Scrap In Heavy Decline

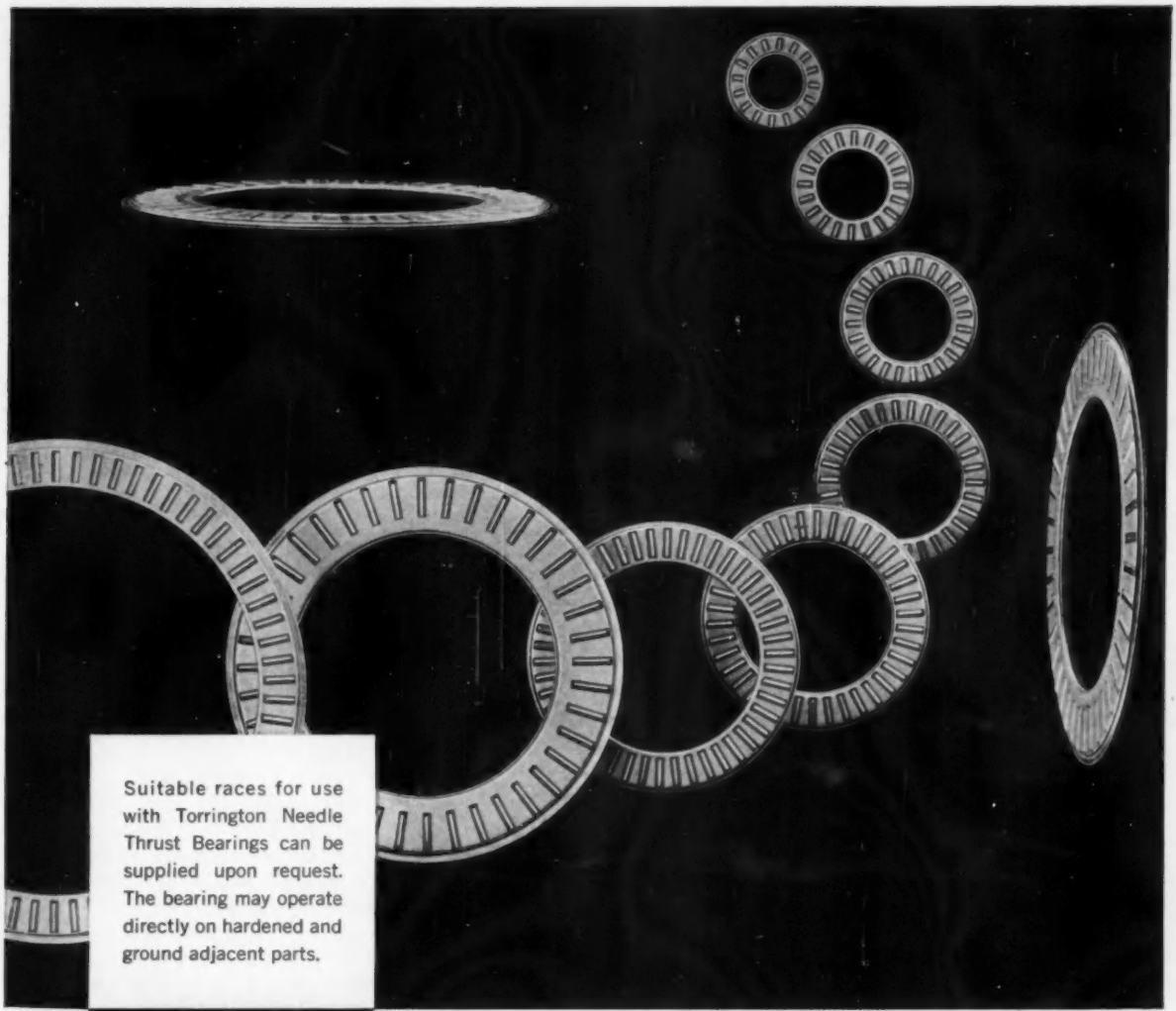
Those who declared a few months ago that falling prices for scrap presaged a drop in the steel operating rate can feel their crystal ball has served them well. Early in April, the price of No. 1 heavy melting scrap dropped to $43 a ton, the lowest price since 1955 and a decline of about $24 a ton since the first of the year.

Weakness extended to every steel-making center, and some dealers anticipate even lower prices. Most mills have adequate scrap supplies bought last Fall. Export demand is hampered by Federal curbs.

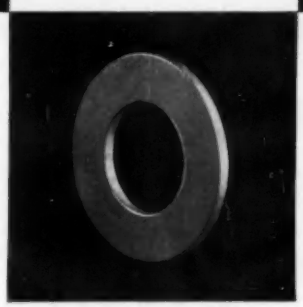
## Copper Price Stabilizes

The copper market looks more stable. Following the cut in the producers' price to 32 cents a pound, the custom smelters cut to 31½ cents, and the metal dipped below 30 cents on the London Metal Exchange. The stage seemed set for another slash by producers who sell directly about 80 percent of the domestic copper, but they held the line. Instead, the custom smelters advanced their price by slow degrees to 32 cents, and London edged upward over 30 cents again.

It appears that the world price will settle somewhere between 30 and 32 cents. An impartial London observer declares that the U. S. primary producers will do all they can to maintain a floor price of 32 cents and will probably attempt to raise this as soon



Suitable races for use with Torrington Needle Thrust Bearings can be supplied upon request. The bearing may operate directly on hardened and ground adjacent parts.



# Torrington's new Needle Thrust Bearing grows in popularity...and range of sizes

Designers have been quick to take advantage of the compactness, high thrust capacity and low unit cost of Torrington's new Needle Thrust Bearing.

To meet the growing demand for this bearing in automatic transmissions, governors, steering gears, bevel gears, hydraulic pumps, torque converters and many other applications, tooling has been completed to produce bearings ranging from .500" ID to 3.000" ID.

Only .0781" thick, the Torrington Needle Thrust Bearing is thin as an ordinary thrust washer, yet brings all the advantages of anti-friction operation to applications where space is limited. Mating steel retainer halves are joined securely to form a self-contained unit that is easy to handle and install.

Plan today to evaluate the Torrington Needle Thrust Bearing. Services of our Engineering Department are available to help you. For full information, write for Bulletin No. 16, "Torrington Needle Thrust Bearings." *The Torrington Company*, Torrington, Conn.—and South Bend 21, Ind.

**TORRINGTON BEARINGS**

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as an opportunity presents itself.

No doubt this sentiment was influenced by the statement of the chairman of the Anaconda Co. that a survey of U. S. mining costs showed that about 14 per cent of the production costs of domestic copper mines exceed 30 cents a pound, and about one-third exceeded 25 cents a pound. The conclusion naturally followed that American copper fabricators were getting their metal quite cheaply. Thus, there arose the very real possibility that some mines would be forced to close with attendant production losses and hurried bidding-up of prices to restore inventories—a repetition of the old vicious cycle that has been the plague of the industry.

## Brass Business Still Slow

Consumers are not yet coming into the market with determination. Fabricators are not pressing for metal because their own business is slow. The wire mills form an exception because demand is good for their products from the expanding programs of the utilities; but the Connecticut Valley brass mills are still in the doldrums. Demand from the automobile industry is slack, housing starts have dropped to the lowest level in eight years, and the appliance manufacturers are curtailing work schedules. These are important markets for the fabricators.

Some production cuts have been made by two major copper mines, but their example has not yet been generally followed. Foreign copper mines find it difficult or impossible to curtail, even if sympathetic to the idea. A more potent factor in strengthening the market is the loss of production because of strikes abroad in Canada, Chile, and Africa and the likelihood that European demand will improve after reopening of Suez and a pick-up of industrial output with a free flow of oil.

## Zinc and Lead Producers Worried

Zinc and lead producers are deeply concerned as to how long Government stockpiling will continue. It is universally recognized

(*Turn to page* 136, *please*)

# ON OUR WASHINGTON WIRE

**Automobile producers have told the Government they're now playing production "close to the vest." Although they still hope for at least a 6.2-million-unit year, they're gearing materials purchases and inventories as close as possible to production.**

Administration is asking Congress to extend for four years its authority to propose Government reorganization plans. Reorganization legislation will die June 1 unless extended.

**Congressional investigators believe aircraft engine producers can pare their bills to the Government by five per cent a year by eliminating waste and duplication. This would amount to $100 million in the current year. Each jet engine now costs from $125,000 to $250,000; propeller jobs from $50,000 to $100,000 each, and they're getting more expensive.**

Smaller concerns may yet win some tax relief from this year's session of Congress. The relief, if it is granted, will come about through a liberalizing of accounting rules, rather than outright rate reduction.

**Slow motion is to typify the national road improvement program only in these formative years. Even so, suppliers of road-building equipment and vehicles long for more speed. There are numerous reasons why the campaign for better roads doesn't go faster. Some of these are connected with legislation now before Congress. Bills are offered to restrict or forbid billboards close to Interstate highways; to add more links to the 41,000-mile Interstate system; to withhold federal-aid money from states that fail to enforce certain speed limits. Then, of course, there is the question of state financing.**

Substantial progress has been made toward commercial production of titanium sheet alloys with strengths 30 to 50 per cent greater than previous alloys, Defense Dept. announces.

**President's Council of Economic Advisers estimates the nation's gross national product climbed to a seasonally adjusted annual rate of $427 billion in the first quarter.**


**An Air Force bomber traveled approximately 600,000 miles without a major overhaul of its six jet engines. This distance is equivalent to flying to the moon and back as well as circling the earth 17 times.**

•

**Tomorrow's aircraft, glowing a brilliant red as it races through the sky at eight times the speed of sound, will radiate enough heat to warm 15 city blocks.**

•

**First U. S. turbojet aircraft engine to complete 1400 hours of operation without major overhaul was built by an automotive company—1400 hours, in air miles, equals 30 trips around the world.**

•

**Total U. S. petroleum production in the past 10 years is valued at $62 billion—about equal to the total value of all other minerals, metals, and fuels produced in the nation.**

•

**In the budget of the average American family, automobiles and their fuels and maintenance rank immediately below food, shelter, and clothing.**

•

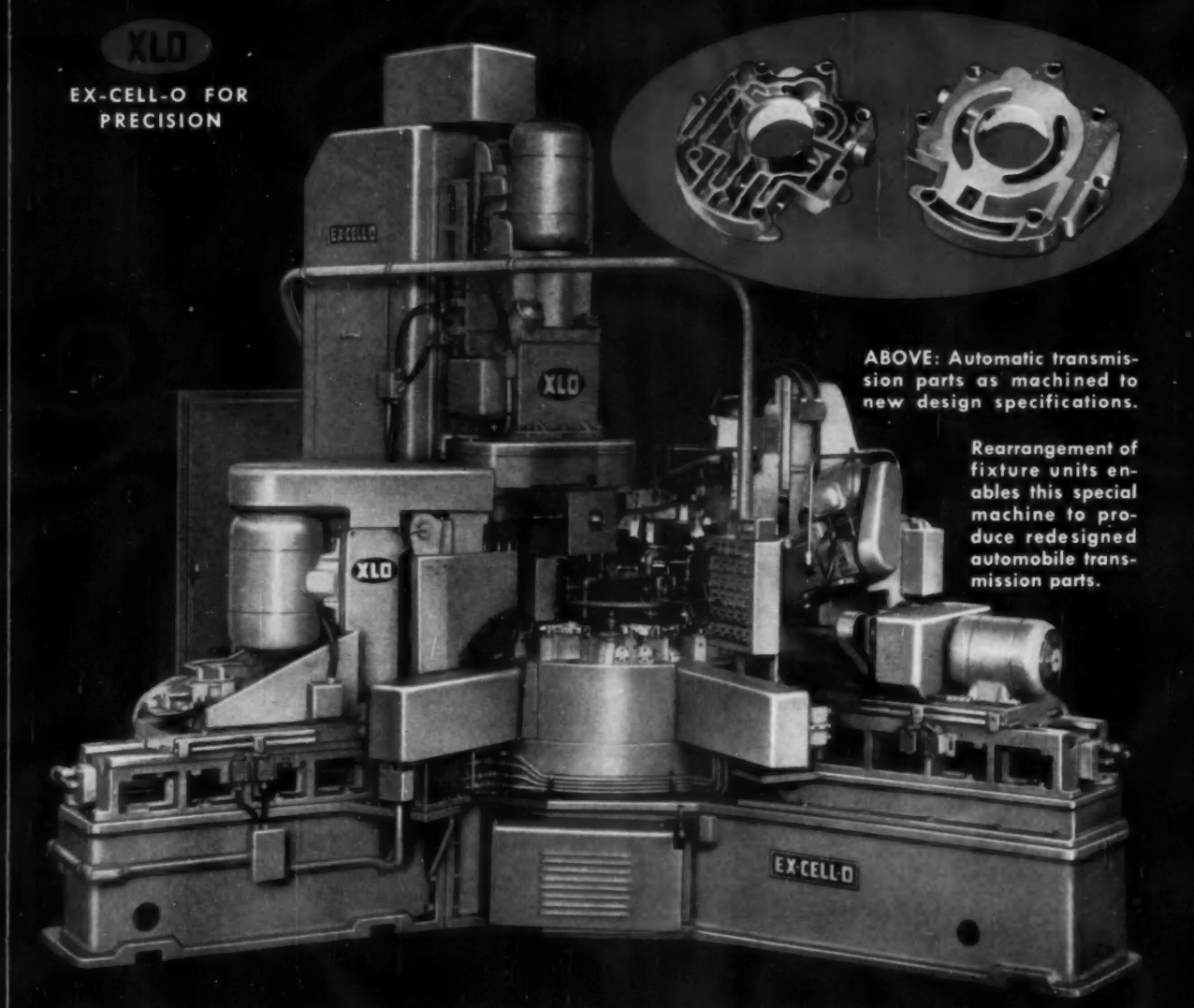
**In the entire world, there are now approximately 95 million motor vehicles operating on 9.8 million miles of roads.**

•

**More than 47 per cent of all radios built in the U. S. are designed for automotive use.**

XLO

EX-CELL-O FOR PRECISION




ABOVE: Automatic transmission parts as machined to new design specifications.

Rearrangement of fixture units enables this special machine to produce redesigned automobile transmission parts.

# Parts changes didn't obsolete this special

## Easily Adapted to Altered Workpieces

The first big parts change to come along will obsolete many a special machine—at a drastic cut into the production budget! But not so with this Ex-Cell-O special now operating at full tilt in an automobile plant in Detroit.

Built to process regulator valve bodies for automotive transmissions, this special machine was flexible enough to adapt to certain changes in tooling and operational cycles. Right now, it's turning out complicated parts at the rate of 120 per hour.

Machining includes fly-cutting both flat sides of aluminum part; drill and ream two piston holes; drill three angular holes; drill, ream and chamfer the top holes. Flatness of the two sides is an important requirement.

Ex-Cell-O specials have the extra precision you have come to expect of XLO products. Why not check with your Ex-Cell-O representative today? Or write Ex-Cell-O, Detroit.

**EX-CELL-O CORPORATION**
DETROIT 32, MICHIGAN
*Machinery Division*

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

57-26

# Automatic Spray System *for* Heat-Resistant Lubricant

*Shown in right center of illustration is spray-lubrication of trolley-wheel bearing-race while heat-resistant 'dag' colloidal graphite. Six 100-ft long conveyor lines, similarly lubricated, carry cores and molds into baking ovens at Studebaker-Packard.*

CONVEYOR lubrication problems caused by the high temperatures in the drying and baking ovens at Studebaker-Packard Corporation's Foundry Department, South Bend, Ind., have been solved by an automatic spray system made possible by the use of a colloidal graphite lubricant, "dag" Dispersion No. 2404. Mineral spirits, the liquid carrier in this product, provide sufficient wetting action to bring the lubricant into contact with all surfaces of moving parts. The carrier then evaporates, leaving a thin, tenacious lubricating film of graphite. "Dag" No. 2404 is manufactured by Acheson Colloids Co.

At the foundry, racks of molds and cores for castings used in Studebaker-Packard products are placed on conveyors and carried through baking ovens at operating temperatures varying from 250 F to 450 F. Prior to using colloidal graphite on the conveyors, a heavy grease and then a conventional non-graphited oil were employed. Neither proved satisfactory. The heat caused gumming and partial decomposition of the oil, leaving a residual deposit that clogged the bearings. This resulted in excessive down-time for the conveyor, as well as cleaning and parts replacement.

"Dag" No. 2404 diluted 20 to 1 with a low-carbon oil forms a dry-lubricating graphite film over bearings, bushings, races, and other critical parts. It is applied in the same manner as the previous non-graphited lubricant and requires no change in our feed system. It does not burn off or leave an oily base for abrasive dust or a sticky residue to "freeze up" bearings. Not only has this resulted in worth-while savings in lubricant and labor, but marked reductions in conveyor wear have been noted.

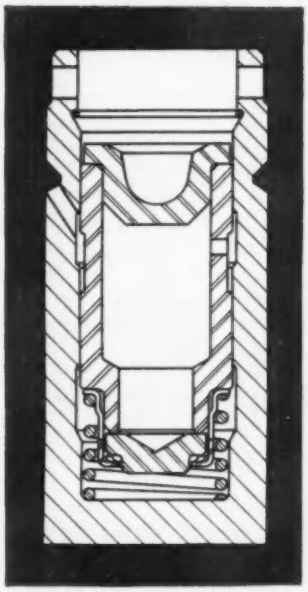
The graphite lubricant is used on six 100-ft long conveyor lines serving horizontal ovens and chains serving six 30-ft vertical ovens used for drying cores.

Each conveyor line is equipped with a six-quart Norgreen lubricator located at the point where the bearings have lost considerable oven heat and are close to room temperature. In the case of the vertical ovens, racks are loaded on the "up" side. Cores are dried in the upper section and unloaded on the "down" side; chains are lubricated below floor level at which point they are ready to repeat the cycle.

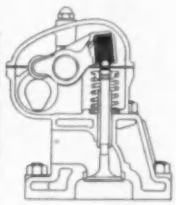
Lubricator reservoirs are pressurized by means of solenoid-operated air valves. The tripping mechanism for the solenoid valve was designed by Studebaker personnel. Here's how it works: a lever is tripped by a cam on the moving trolley; the lever depresses a half-inch diameter button switch, closing the electrical circuit which energizes the solenoid. The solenoid opens the air valve, and the lubricant is forced under pressure to the spray nozzle. Timing is governed by the speed of the conveyors and oven chains.

Two different spray nozzles are used on the horizontal conveyors. At one lubrication station, a twin nozzle is positioned so that the colloidal graphite dispersion is sprayed on the trolley-wheel bearing races. At another station, the spray is timed to deliver when the small-nose sprayhead is in alignment with the bearing retainer. The spray nozzle is a piece of $\frac{1}{8}$-in. copper tubing flattened at the end to a slit opening. Microscopic and sub-microscopic in size, the "dag" colloidal particles will not clog lubricator nozzle orifices, or passages of the lubricators. Maintenance of the lubricators amounts merely to infrequent cleaning of dust that has settled on the units.

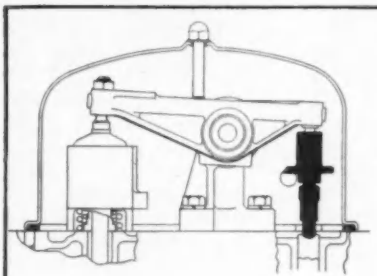
# Valve gear engineering is a specialty at Chicago Screw Company



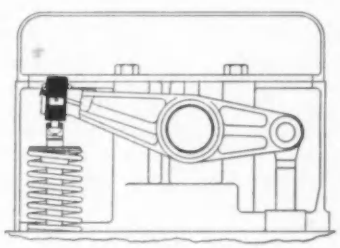
CHICAGO SPRING-LOADED FLAT VALVE HYDRAULIC TAPPET



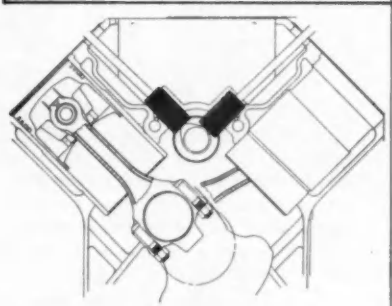
INSERT TYPE ROCKER ARM UNIT



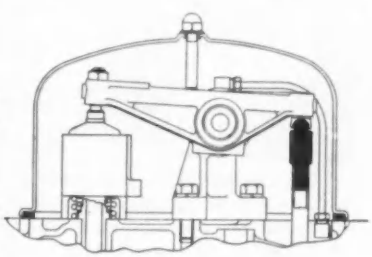
PUSH ROD TYPE FOR COMPRESSION RELEASE APPLICATION



THREADED TYPE ROCKER ARM UNIT



V-8 AUTOMOTIVE HYDRAULIC TAPPET APPLICATION



HYDRAULIC UNIT ON END OF PUSH ROD

### *Design*

of complete valve gear installations for any type of engine . . . passenger car, truck, tractor, diesel, aircraft or industrial.

### *Development engineering*

based on years of specialized experience in valve gear problems. The skills of our engineers will prove a valuable addition to your own engineering staff.

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# New Uses for Welding Discussed at AWS Meeting

WELDING materials and equipment sales rose to $350 million in 1956. Actually, the total value of products fabricated by the welding process is some 50 to 100 times the amount of the welding industry's sales. These facts were announced at the opening of the National Welding Meeting and Exposition, sponsored by the American Welding Society in Philadelphia last month.

Dr. D. C. Smith, director of welding engineering, Harnischfeger Corp., Milwaukee, Wis., who delivered one of the principal technical lectures, declared that welding electrodes have been developed to keep pace with the new high strength steels. This important development, which insures that the new steels may be fabricated into useful products, was reported by Dr. Smith as the culmination of research begun during World War II. High tensile weld metals of strengths from 100,000 to 300,000 psi have been developed, he said.

Dr. Comfort Avery Adams, 88, founder of the AWS and noted welding and electrical engineer, was honored at the sessions. An oil portrait of Dr. Adams was presented to him.

Clarence P. Sander, Los Angeles, Calif., was elected president. Mr. Sander, who is general superintendent, Vernon plant, Consolidated Western Steel Division, United States Steel Corp., takes office June 1.

Other officers elected were Gustav O. Hoglund, head, welding section, process development laboratory, Aluminum Corp. of America, New Kensington, Pa., first vice-president; Charles I. Mac Guffie, marketing manager, welding department, General Electric Co., York, Pa., second vice-president, and Harry E. Rockefeller, manager, electric welding, Linde Air Products Co., New York, treasurer.

For the first time, the American Institute of Electrical Engineers joined in the sponsorship of several technical sessions. The institute's committee on electric welding participated in a number of the discussions. A highlight of the papers was the use of welding in atomic development. Research developments on the designing and fabrication of nuclear reactors, techniques for welding parts of reactors, and the effect of neutron radiation were among the topics considered.

The show was one of the largest ever undertaken in the field. About 2500 items of equipment or accessories were displayed.

One of a host of interesting technical papers given at the meeting is presented herewith.

## Stress Corrosion Cracking of Titanium Weldments

***By W. L. Arter and R. Meredith, North American Aviation, Inc.***

A PROTOTYPE tank containing resistance and fusion welded joints was fabricated from RC A110 AT titanium alloy. The tank was filled with a chlorinated hydrocarbon, Monsanto Arocolor 1262, and pressure tested at 700 F. Numerous transverse weld cracks developed.

An investigation was conducted to determine if these cracks were caused by:

Stress corrosion resulting from contact of the chlorinated hydrocarbon with the weld joints at elevated temperatures; embrittlement of the titanium as a function of time at temperature only; and embrittlement caused by improper welding techniques.

The following tests were conducted:

1. Specimens containing circular patch welds were loaded to 70,000 psi and heated in air for three hours at 700 F. None of the specimens cracked.

2. These same specimens were again loaded to 70,000 psi, immersed in the chlorinated hydrocarbon used for testing the prototype tank, and heated to 700 F for three hours. All of the specimens developed cracks. The cracks showed a tendency to follow the direction of rolling.

3. Specimens from the prototype tank were bend tested. Results indicated that the ductility of welds and parent metal did not change during the pressure-temperature test of the tank.

4. Microhardness traverses were made across several welds. No abnormal increase in hardness was noted in the weld area.

5. Notched and unnotched weld and parent metal specimens, cut from the prototype tank, were tested at room and elevated temperatures. Results indicated nothing abnormal about weld or parent metal properties.

6. Chemical analyses were run on samples cut from several locations on the tank. These showed a normal composition with a hydrogen content of less than 125 ppm.

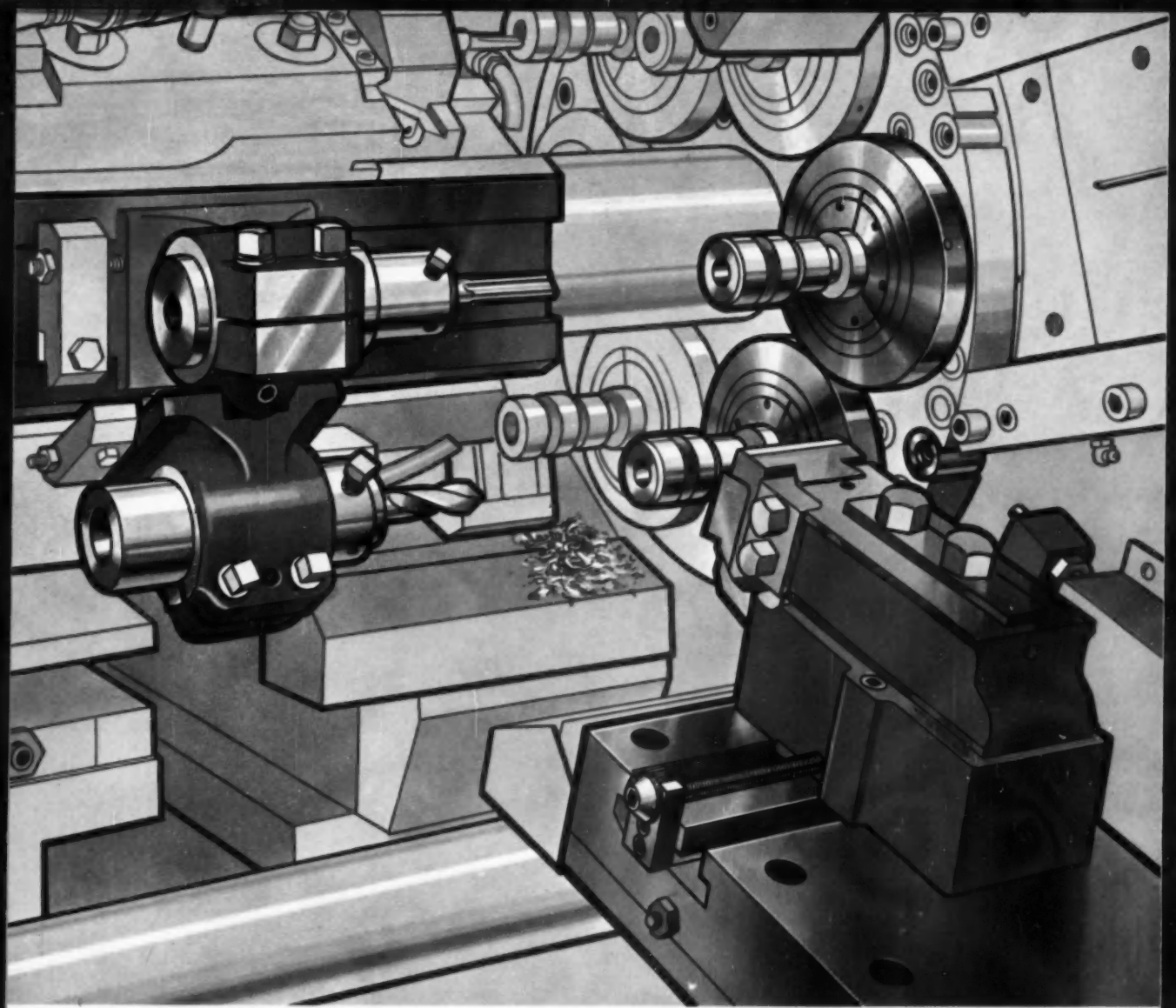
7. Metallographic studies were made on several cracks. These indicated the cracks were not typical of those ordinarily associated with stress corrosion. Multiple fissures near the head of the crack were not in evidence.

8. Parent metal specimens containing no welds were loaded to 70,000 psi and heated in the chlorinated hydrocarbon for three hours at 700 F. None of the specimens developed cracks.

9. An outside laboratory conducted tests which duplicated those described in number 8. Several of the specimens tested by this laboratory developed cracks.

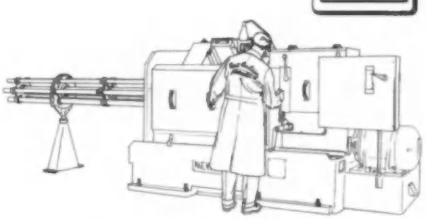
10. Additional circular patch specimens were fabricated. Half were prestressed to 70,000 psi and thin stress relieved. Half were stress relieved in the as-welded condition. These latter specimens were then stressed to 70,000 psi. All specimens were heated in the chlorinated hydrocarbon for three hours at 700 F. None of the specimens loaded before stress relieving cracked. All of the specimens loaded after stress relieving cracked. Cracks showed a definite tendency to follow the direction of rolling.

From the results of these tests, it was concluded that the chlorinated hydrocarbon causes the development of stress corrosion cracks when placed in contact with RC A110 AT titanium aloy at 700 F. This should open a new area of investigation on the properties of titanium welds. If it is a typical characteristic, it could limit the use of titanium by the chemical industry or require the development of alloys which are not susceptible to this type of stress corrosion.

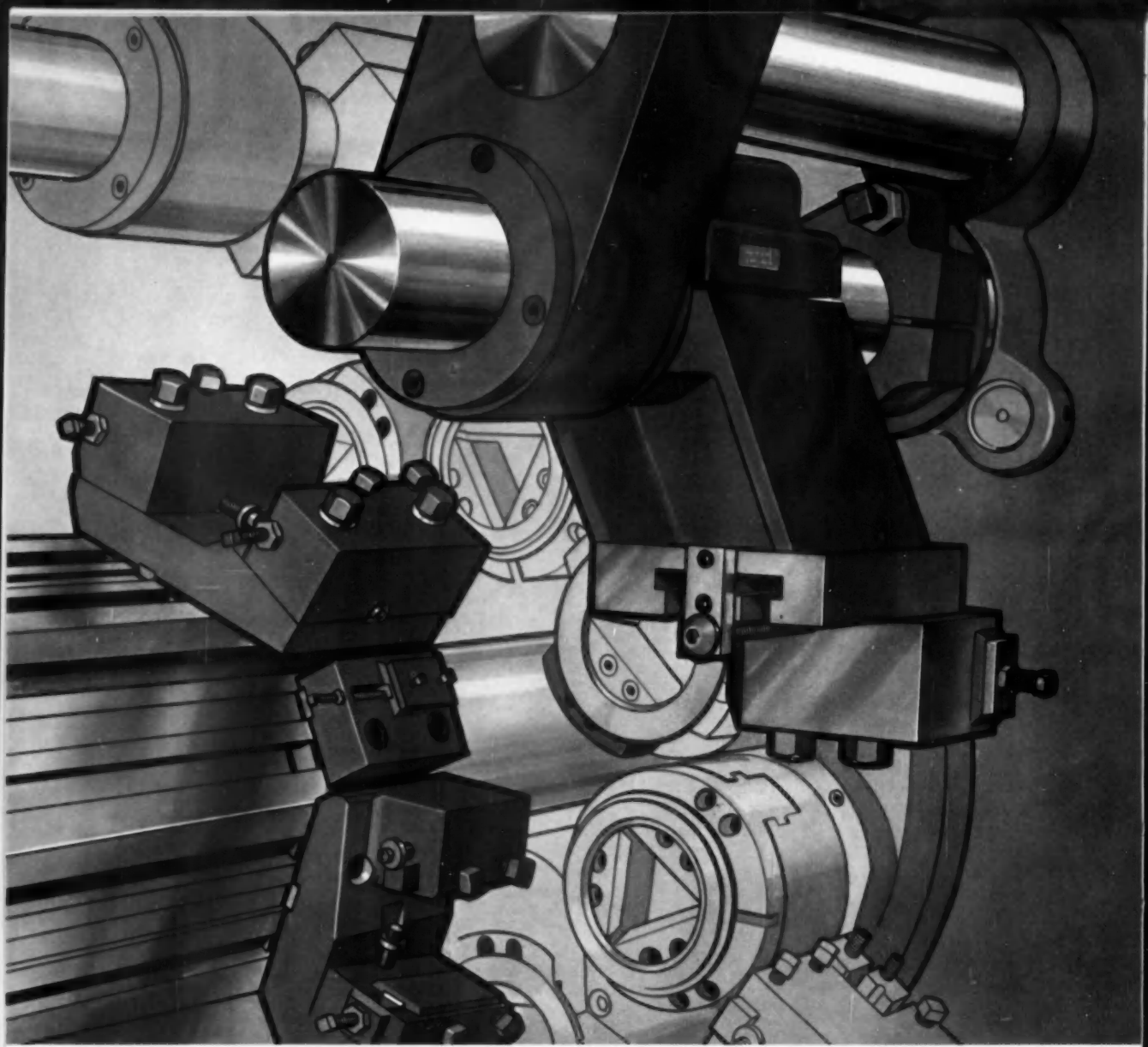


# less wear means more profit

New Britain bar machines are "built to stay accurate." Hardened spindle nose cross slides, eccentric cross slide stop buttons and tool slides, plus carrier lifting during index, are only a few of many *exclusive* New Britain features for preserving long-run accuracy. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.



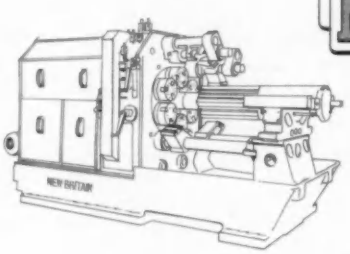
Automatic Bar Machine



# when the job calls for a big, husky chucker

## pick a New Britain

New Britains are massive, not only in over-all size and weight, but in every individual feature. Rugged forming arms and tool slides transmit smooth power to the cutting edge in every position. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.



Automatic Chucking Machine

## GENEVA SHOW

(*Continued from page* 58)

for both engines. Since both cars will be run on the Monza track in a clockwise direction, there is slightly more weight on the right hand or inner wheels which will be offset by centrifugal force. Only the front wheels are fitted with brakes.

Other new Farina models include a two-four passenger body on the Lancia Appia chassis, a very trim coupe on the Fiat 1100 TV with four seats, and a magnificent convertible on the Lancia Aurelia Gran Turismo chassis.

The Lancia Flaminia sedan, first shown at Turin in 1956, was styled by Pinin Farina and may be considered as the production type version of the Florida four door, hardtop sedan. In the meantime, development work on this car has gone on, and the hardtop, pillarless body has been replaced by a four door sedan with both doors hung at their front edge. The car is now scheduled to become available in the second half of the year. With its V6 engine of over 2½ litres, its fully synchronized four speed transmission built as a unit with the rear De Dion axle and its dignified lines the Flaminia holds an outstanding place among Continental luxury sedans. Apart from this model, on the Lancia stand, the sports version of the small Appia 2nd series was shown with two magnificent special bodies by Pinin Farina and Vignale.

The Appia, which continues as a pillarless, four-door, four-seat sedan besides the faster chassis version with special bodywork, is going to remain the mainstay of the firm for some considerable time to come. The power output has been raised from 43.5 hp at 4800 rpm to 53 hp at 5200 rpm.

On European cars with less than 125 to 150 cu in. engine capacity per ton of weight, hydraulic transmissions are apt to reduce overall efficiency and acceleration to such an extent that their general application is doubtful. A fair compromise is reached by the automatic clutch control which has become a popular extra on British and French cars. In a hilly

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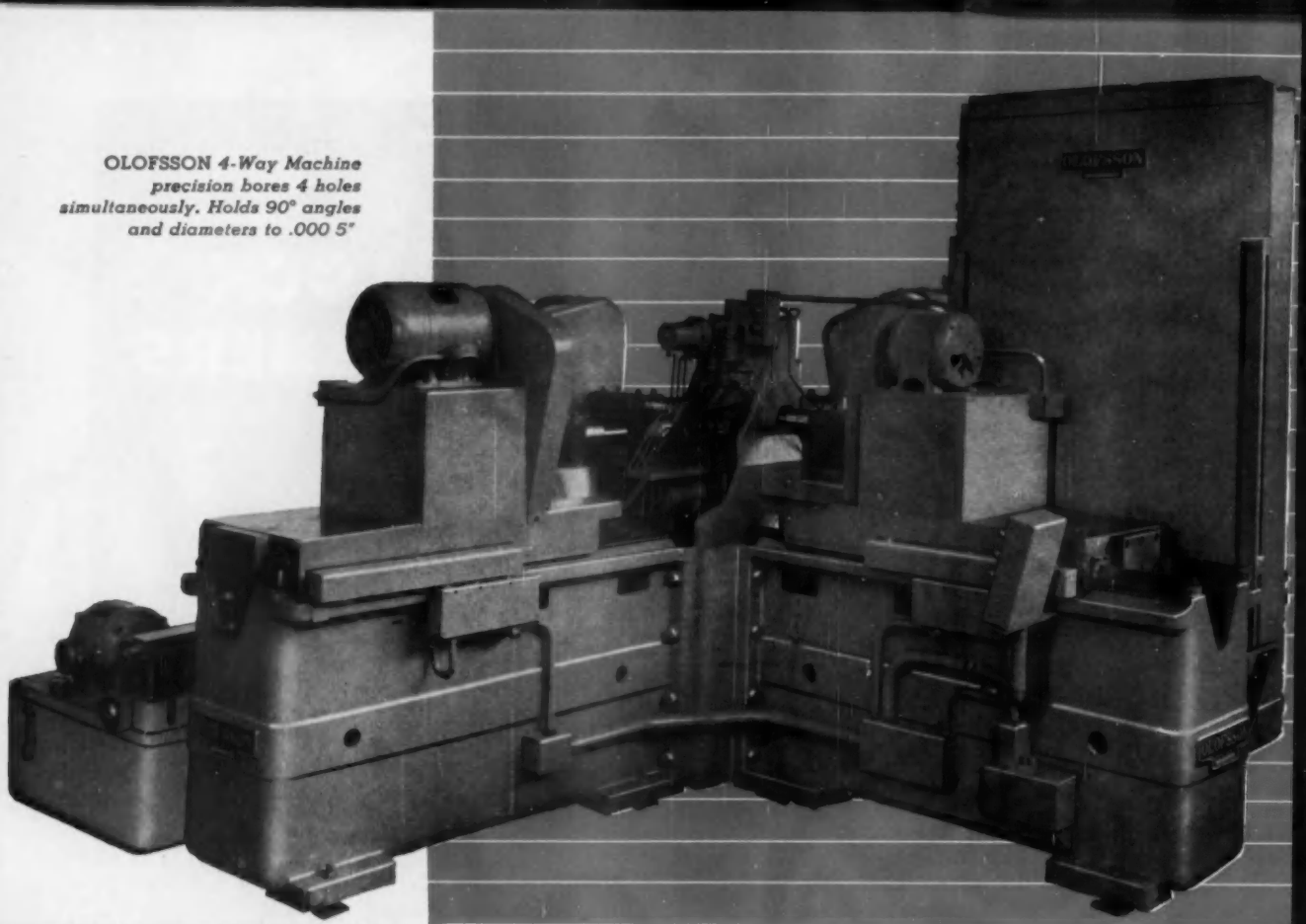

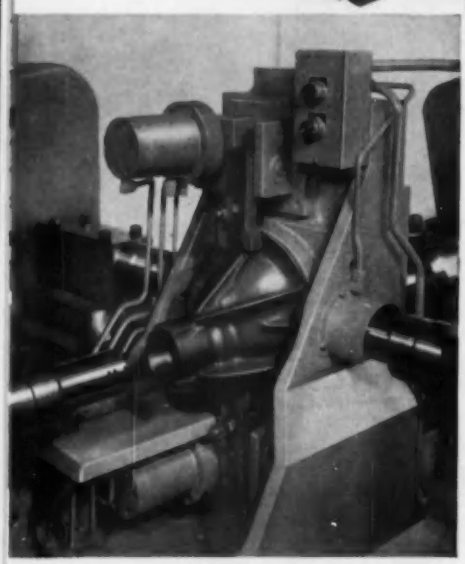

*Close-up view of differential carrier, hydraulically cam-clamped in position for boring.*

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country such as Switzerland it is imperative that these controls, which in most circumstances include a centrifugally operated clutch for stopping and starting, may be locked when a vehicle is parked on a gradient, since it is not lawful for a vehicle to be fitted with one means of blocking only.

This is one of the reasons why a new German pedalless clutch control, developed by Fichtel & Sachs and named Saxomat, has caused special interest. As soon as the engine is stationary a locking ratchet engages and creates a solid power line from the driven wheels to the engine and disengages as soon as the engine starts. The Saxomat is fitted to the DKW two-stroke, three-cylinder model as an optional extra, the first German car to be so equipped. There is a centrifugal clutch, with weights fitting into grooves in the flywheel, which engages at approximately 700 rpm. In addition to this, an electrically-controlled, vacuum-operated servo motor declutches automatically as soon as the gear lever is touched and allows for a quick gear shift to be effected. In order to prevent engine stalling during gear shifts an additional linkage raises engine speed to 1200 to 1700 rpm between changes.

Only three body builders from Switzerland remain active, but their products merit attention. Ghia-Aigle forms the link between the Swiss and the Italian specialists, all its bodies having been designed by Michelotti. Apart from the Lotus there are Volkswagen, Lancia and Alfa Romeo coupes, all with short stubbed and short finned rear fenders, low and wide hoods, curved and slightly broken body sections. A long and low coupe body on a VW chassis with Porsche engine and brakes has been evolved by Beutler.

Graber bodies on Alvis and Bentley chassis have well-proportioned lines and excellent finish. The three-litre Alvis, shown both in standard and de luxe form, is considered a modern classic and the behavior of the chassis has been influenced by modifications introduced or suggested by Graber.

Numerous exhibits by smaller

(*Turn to page* 114, *please*)

# RELAX!...

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It's the *detail* work that causes exasperation. Like designing springs.

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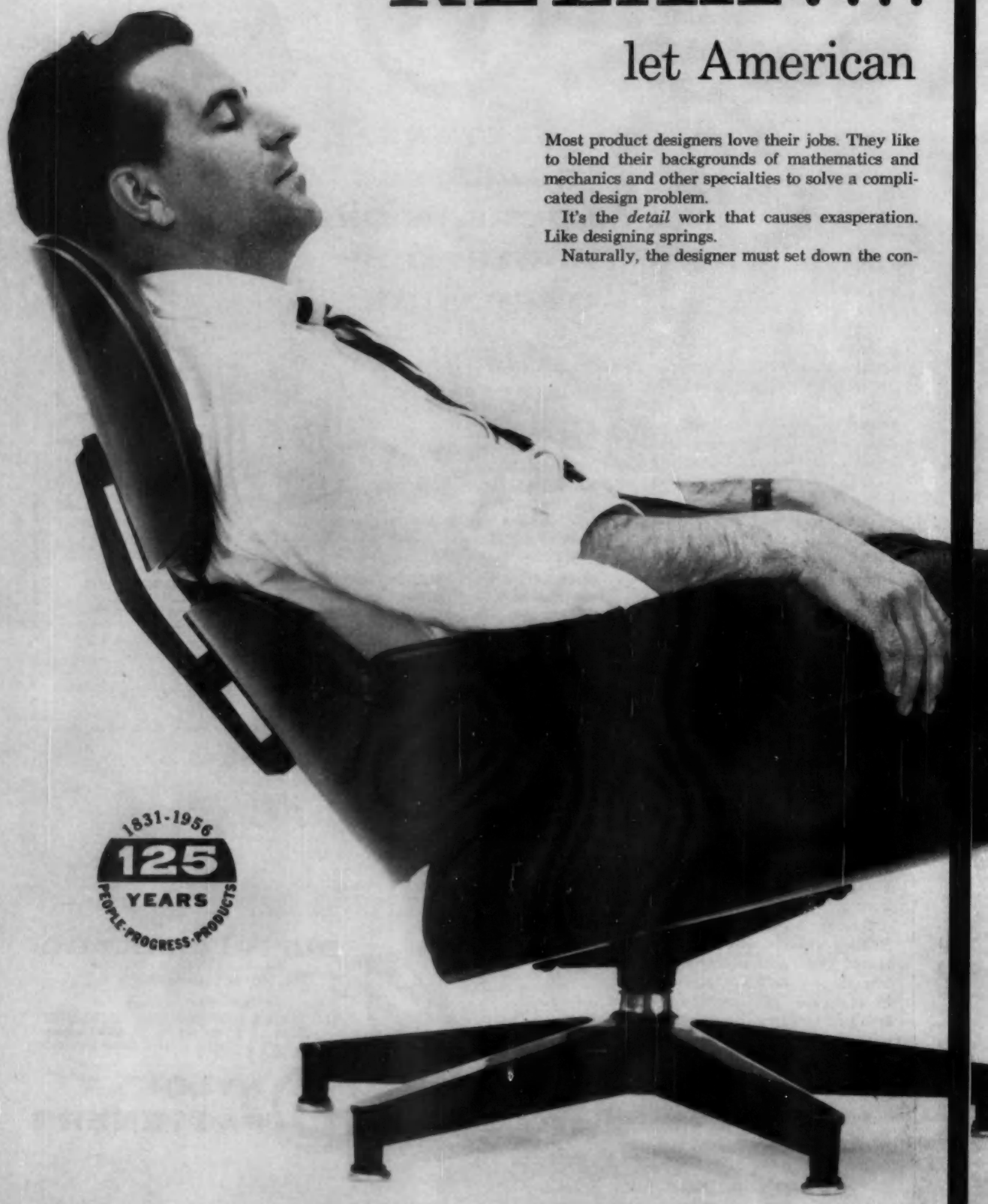

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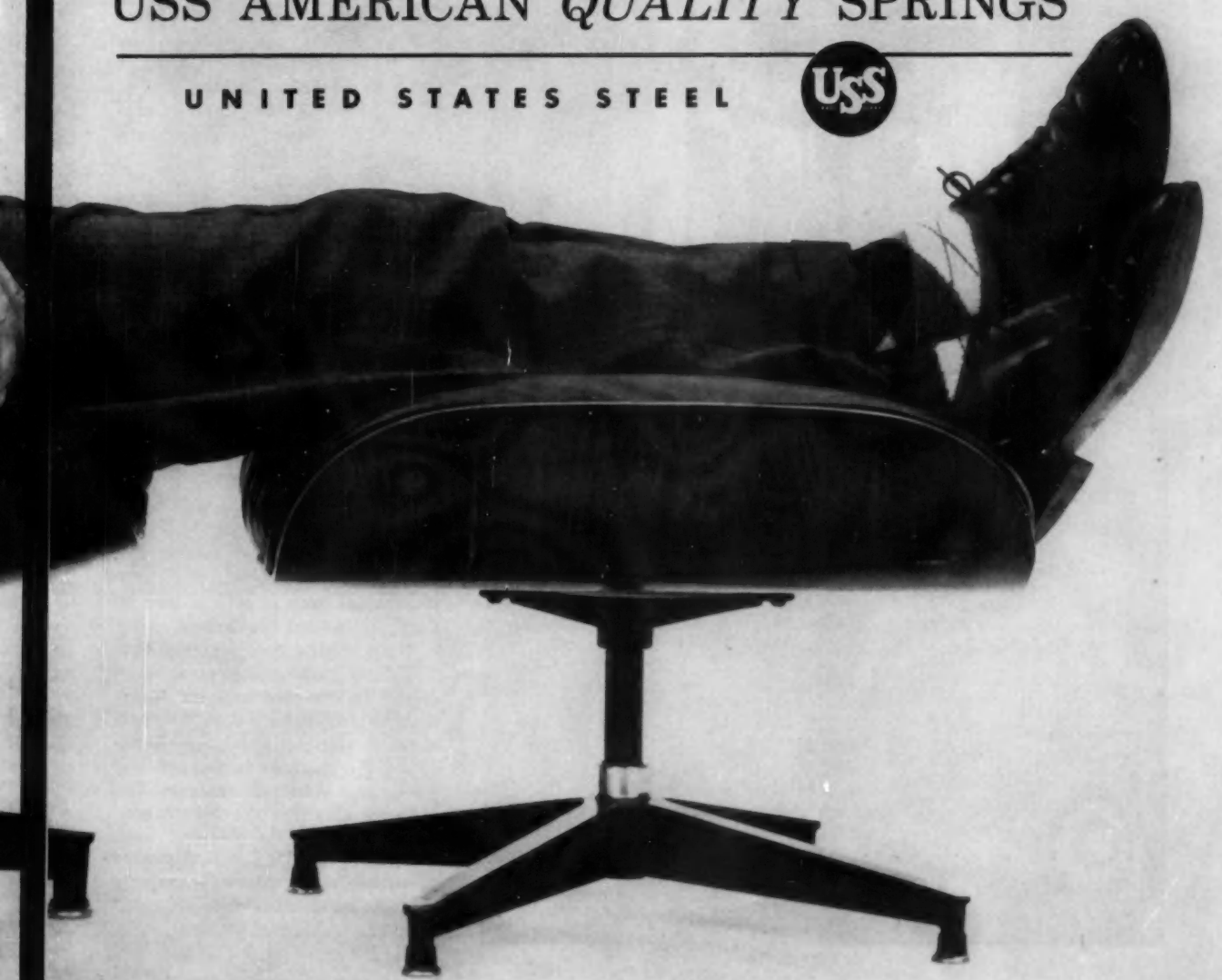
UNITED STATES STEEL



## GENEVA SHOW

(*Continued from page* 111)

makers show that the Swiss market holds many attractions for them. Thus, a new version of the Panhard engined plastic DB sports coupe from France, the Austrian Denzel sports roadster based on Volkswagen and Fiat parts (a Denzel engine is now available for the Karmann Ghia Volkswagen coupe), the Heinkel-engined Maico minicar and numerous other makes vie with each other for a small place in Switzerland.

## MACHINERY NEWS

(*Continued from page* 93)

station, caps are pressed over the bolts from below. At the third station, nuts are fed through the hollow offset spindles of the air motors and driven to the proper torque. The transfer fingers automatically unload the rod by pushing the assembly off the end of the support bar.

Bolts are fed by a vibratory feeder down a gravity track. Due to the oval non-symmetrical shape of the bolt head, the bolts are fed through a special orienting device which properly aligns the bolt head prior to insertion in the rod.

The nuts are handled in an elevator type hopper and brought down to the air motor spindles by gravity tracks. Nut escapements push the nuts into the hollow hex drive spindles which in turn drive the nuts onto the pressed-in bolts.

For ease of maintenance and to save floor space, the machine has been designed as a series of subassemblies each of which may be easily rolled out for service.

The machine is so designed that a missing bolt, nut or cap is automatically detected and the information is transmitted to the operator by signal lights. Simultaneously, the machine is stopped and goes into manual control. The operator may then correct the condition and put the machine back in auto cycle. This will minimize downtime and insure that only perfect assemblies are unloaded from the machine.

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## Advanced Tooling for Ferguson Tractor

(*Continued from page* 65)

form of the three wheels in sequence. Positioning of each diamond is hydraulically controlled by a separate tracer and templet during its cross travel, and radii on both sides of the wheels as well as their faces are copy - dressed. Two of these grinders are used to meet the time-cycling requirements.

Crankpins are milled on a Heller four-spindle machine. The upper and lower pairs of milling heads on individual vertical slides follow their respective throws on the rotating shaft, with the cutters covering the diameters and webs.

A Heller double-ended drum-type machine works both ends of the crankshaft in 10 stations. The forward end is turned, faced, drilled, tapped, chamfered, and milled for three keyways, while the flywheel mounting flange is completely turned, bored and profiled, and six holes are drilled, counterbored, reamed and tapped.

Oilways are drilled and taper-tapped on a pair of identical Huller multi-spindle machines which have automatic cycling, including work positioning and clamping. The fixture, carried on an extended slide, travels clear of the tool area for loading and unloading. When the shaft is manually placed in position and the cycle started, the hydraulic clamps are secured as the fixture moves into the machine. This sequence is reversed when the work is finished. There are four angled heads with single and multiple spindles, and two of these have indexing turrets for consecutive drilling, boring, tapping (for the closing plugs) and chamfering.

Pin grinding is shared by two Naxos - Union twin - wheeled machines, one doing the two inner cranks and the other the two outer ones. Finally, all crankshaft diameters are finish-ground on a multi-wheel machine.

Cylinder blocks for the Diesel engine are machined on an aggregate of four transfer lines linked by roller track, with a total of 48 stations. Castings start out on

their sides on the first 11-station Heller that initially mills the head and oil-pan faces and front and rear faces, and drills two location holes on the bottom. Blocks are turned to vertical and the cylinders of this sleeved engine are rough bored, and later the camshaft holes and the main bearings are bored.

In the following 17-station Archdale the maniford faces and other areas are drilled and tapped. At a second 11-station Archdale the end faces are drilled, tapped and reamed. Finally, a 9-station Heller line semi- and finish - bores the cylinder and top recesses to hold the liners, main bearing and cam holes, starter motor and pump bores, and skim-mills the head face.

A Gehring honing unit is built into the last station, where the block is clamped by a guide plate with sleeve extensions for holding the four retracted hones during transfer. Automatic sizing stops the reciprocating action when the specified limits are reached. If any bore is still undersize when the prescribed cycle time for the line is reached, the block is moved from the exit track to an adjacent single-spindle machine where the individual bore can be manually honed.

Diesel heads are machined on four automatic transfer lines with 27 stations. The first is a four-station Heller with milling heads on each side operated by two main hydraulic cylinders. Castings, placed with manifold face up, slide in guide channels along the center bed, and are moved by an overhead transfer bar with drop arms having a three-foot stroke. After each index the work is clamped from above, and the milling heads traverse in tandem across the top and bottom faces. At the last station one end face of the casting is milled by a cutter set to one side of the line and at right angles to it. Diesel heads are fed into this by a cross - traversing section of guide rail.

The next series of three Archdale lines drills and taps the top, bottom and manifold faces, and machines the valve seat and pre-combustion chamber recesses.

Final tractor assembly is at Banner Lane, where the basic unit is the transmission housing sub-assembly. This is placed across the main track at the start, after which the completed engine and rear axle on individual adjustable dollies are brought up on either side and bolted to the two flanges. With the dollies removed, the parallel chassis accumulate further parts as the track moves ahead.

At the end of the first section the chassis are picked up by a monorail conveyor that carries them to a hand spray booth where the few exposed metal parts are primed. The conveyor then moves them on and up into the continuous electrostatic spray booth and ovens where the final coats of metallic bronze are applied and baked. This long tunnel loops back on itself alongside the assembly line, and terminates at the start of the second section of track.

There the end-on chassis take on the radiator, gas tank, wheels, and gray-painted pressings such as hood and grille, fenders and bucket seat. Engines are then started, with exhaust piped through an overhead duct. At the end the tractors are driven off under their own power to the testing and shipping bays.

## Flexible Equipment

(*Continued from page* 51)

with a single spindle Barnesdril Plugmatic type honing machine with automatic cycling and sizing. Experience to date has indicated that the machine will repeat bore size within a limit of 0.0002 in.

Coming to cylinder heads, we find that initial milling of the various surfaces is done in Ingersoll mills, employing the familiar Sundstrand magnetic plates for holding the work. Milling cutters are of "shear-clear" type, carbide tipped. Exhaust and water pad sides are milled in a two-spindle Sundstrand fitted with a two-station magnetic holding fixture.

Drilling of the block contact face—38 spindles—and drilling of 28 additional holes in the same face is done in a Natco drilling machine. Milling of the four pockets for spark plug holes, and drilling of spark plug holes is done in a special setup with horizontal heads, the fixture being arranged to hold the work at an

angle of 40 deg. The same fixture is used for Diesel heads as well.

The variety of other operations are handled in a similar way on the same kind of setup. Following reaming of valve guide bores, valve guides are pressed in on a new 25-ton Oilgear hydraulic press. Countersinking, counterboring, and tapping of all holes are done with the old reliable radial drill.

Following completion of detail operations and water testing, the block contact face is given a finish-milling cut in a vertical mill, fitted with a magnetic holding plate. This operation removes about 0.015 in. of stock to provide a clean and smooth gasket surface.

It may be noted in closing that much simpler setups are employed for machining manifolds and timing gear covers due to the variety of parts. Variability is quite extensive in the case of cover plates due to individual customer specifications. Nevertheless, even in the case of these parts Hercules has developed a number of fixed setups with more or less universal type work holding fixtures.

The final assembly line, illustrated here, also exemplifies the philosophy of flexibility. The assembly unit, provided with a power-driven chain conveyor, has pallets that will accommodate all engines in the line and at any given time may have a full assortment of gasoline and Diesel engines going over it.



## OBSERVATIONS

(*Continued from page* 98)

portant if more volume is to be realized. We recall one designer telling us some time ago about meetings on model changes. He came prepared with drawings of fresh styling. During the course of the session the president asked his sales manager how sales were going. The answer was—"good." Why should we change styling if the cars are selling, the president inquired. So they forgot about styling changes for another year.

### Diesel Weight

Recent discussion about gas turbines and gasifier turbine powerplants indicates that both types are aiming for competition with gasoline and Diesel engines in trucks and farm tractors. This led us recently to check up on the weight of the automotive types of Diesel engines. We took the data from the 1957 Statistical Issue of AUTOMOTIVE INDUSTRIES. Selecting only those engines that are intended specifically for truck and industrial applications, we trimmed the list further by using values only for engines in the range of 100-200 hp. On this basis the weight per hp (continuous duty rating) presents some interesting features. The range of this ratio is from 9.7 to 28.6. The median value is 16.4. The arithmetic mean is 16.75. Even the high speed Diesel turns out to be extremely heavy by comparison with gasoline engine practice.

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You can't ask for stronger proof of ruggedness than the free full year's service certificate covering the Black & Decker Heavy-Duty Impact Wrench. No other manufacturer dares make this offer—because no other impact wrench runs as cool, lasts as long, performs so well.

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## Communist-Built Motor Vehicles Displayed at Leipzig Fair

(*Continued from page* 72)

at 2000 rpm. There is indirect injection with swirl chambers, and cooling in all cases is by a single axial blower.

East Germany's budding aircraft industry made its first appearance at the Leipzig Fair with the display of a twin-engined IL-14P built under Soviet license. The airframe of this transporter, adapted to seat 26 passengers, is made in a new factory near Dresden. Basic specifications are the same as the Russian, with a span of 104 ft, length 69.6 ft, and wing area 1075 sq ft. Maximum ceiling is given as 22,950 ft, range 2000 miles, and cruising speed 200 mph. This aircraft, stated to be in series production and available for export, was described in detail in an expensively-produced English-language brochure.

Engines are made in Chemnitz, and are 14-cyl double-row radials each rated at 1900 hp at 2600 rpm. A newly-erected aircraft hall at Leipzig housed displays of navigation instruments, communications equipment, hydraulic gear and several gliders.

Of interest among other Communist exhibits were examples of China's first trucks—four-ton models based on the Soviet ZIS-150. It is of out-dated but rugged design, and has a six-cylinder side-valve engine developing 95 hp at 2700 rpm. Production of this model, designated Liberation, started in July 1956 at a new Russian-equipped factory at Changchun, Manchuria. An output of 4000 is planned for this year, and when fully operational in 1959 the plant is scheduled to turn out 30,000 vehicles annually.

The Russians had the first public showing of the Moskvitch 402, which bears flattering resemblances to more than one British car. It has a four-cylinder, side-valve engine of 75 cu in. that develops 35 hp at 4200 rpm. Designed for 70-octane fuel, it has a 7 to 1 compression ratio. The car is of integral body-frame construction, and front suspension has double support arms with a coil spring enclosing the telescopic shock absorber, and ball-joint linkage. An English-language booklet on the Moskvitch was available, and it was understood that the U.S.S.R. is pushing exports of this car to the west.

Russia also displayed its larger Volga with automatic transmission, air conditioning, and other technical innovations. It has a 137-cu in. four-cylinder engine developing 70 hp at 4000 rpm. But only one model was exhibited on an inaccessible turntable; close inspection was not encouraged and details were not available.

The new CYCLON BEARING was developed to bridge the wide separation between babbitt and heavy duty copper-lead from the standpoint of fatigue resistance and crankshaft wear. The price advantage over heavy duty copper-lead is considerable.

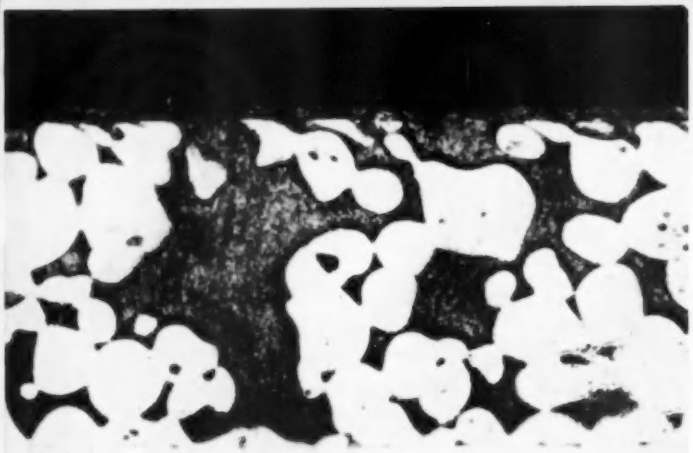
The research and engineering staff at Detroit Aluminum and Brass Corporation have successfully completed performance and endurance tests—the equivalent of over 2-million miles. Results show that CYCLON is as important a contribution to bearing design as the thin babbitt bearing which also was created and developed by Detroit Aluminum and Brass engineers.

The new "CYCLON" is now available for original equipment use and engine manufacturers are invited to determine the superior qualities of the CYCLON through their own testing procedures.

**DETROIT ALUMINUM &**

see next page for
salient features of the
CYCLON engine bearing

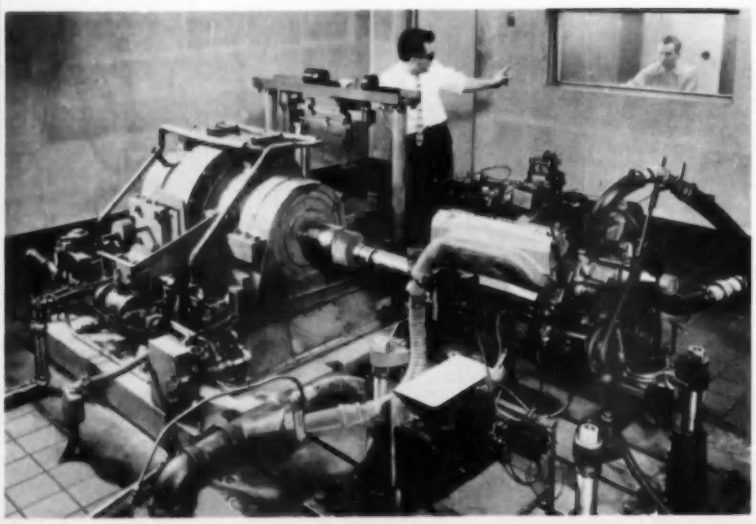
**BRASS CORPORATION**



The micro structure of the new CYCLON ENGINE BEARING is of such a nature that high embedability is obtained without sacrificing load carrying qualities.

## SALIENT FEATURES AND CHARACTERISTICS OF THE NEW CYCLON BEARING

High load carrying capacity.
Excellent embedability characteristics.
Extremely good conformability.
Low scoring tendencies.
High corrosion resistance.
Bronze matrix structure.
Superior thermal conductivity.
High fatigue resistance.
No hardening of crankshaft necessary.
No overplate required.
Low cost advantages.



Endurance tests equivalent to over 2-million miles at wide open throttle indicate in every instance that the CYCLON bearing is fully capable of meeting extreme operating conditions without fatigue failures and without showing appreciable crankshaft or bearing wear.

**DETROIT ALUMINUM & BRASS CORPORATION**

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# AI TABLOID

(*Continued from page 37*)

**Directors of Consolidated Electrodynamics Corp. have approved purchase of the major assets of William Miller Instruments, Inc. . . . Olin Mathieson Chemical Corp. has completed negotiations for purchase of the assets of Southern Electrical Corp.**

* * *

**A. V. Roe Canada, Ltd. has entered the guided missle field by acquisition of the two Toronto plants of Applied Research, Ltd.**

* * *

**Massachusetts Institute of Technology is holding special courses in internal combustion engines and wear theory in metal cutting and bearing design from June 17 to 28.**

* * *

**Du Pont Co. has added "Lino-Flex" 1 oscillographic recording film for oil-well logging, aircraft, and automotive testing, and for seismic exploration to its line of photographic products.**

# PRODUCTION

## *Chief Topic*

***at SAE Aeronautical Meeting***

(*Continued from page* 59)

ductile metallic coatings seem to be limited to use below 2200 F. For higher temperatures multilayer coatings which contain a metallic layer to absorb impact and an oxide phase to provide oxidation resistance may offer some possibilities. For very high temperature short time applications, or for applications when mechanical shock is not a problem, the molybdenum disilicide coatings are attractive.

To summarize briefly, the use of coated molybdenum components in many jet engine applications at temperatures up to 2000 F appears to be very definitely promising, although many problems remain to be solved before molybdenum-base alloys can be used on a production basis. The major challenge appears to be the development of coatings which afford satisfactory protection at temperatures of 2500-2600 F and higher.

# PROBLEMS

## In the Application of High Strength Steel Alloys in the Design of Supersonic Aircraft

By Dipl.-Ing. Alf Fridtjof Ensrud

**Research Specialist**
**LOCKHEED AIRCRAFT CORP.**

DEFINITE progress seems to have been made in the past few years in understanding the problem of aerodynamic heating and the resulting effects on the structural integrity of the airframe. In the range of immediate interest, i.e. Mach 3 or Mach 3.5, it is most likely that a change to more heat-resistant material will become mandatory. How far the application of heat sinks or a stabilization of the boundary layer can help in retaining the use of light alloys can only be guessed at the present time.

By taking advantage of several alleviating factors and by a prudent choice of more suitable mate-

rials and their optimum structural utilization, as in steel sandwiches, some of the problems associated with thermal flight can be greatly reduced. While, in the beginning, there might be a multitude of new problems for the designer as well as the production engineer, all indications point to the fact that they will be mastered in proper time and through the combined effort of the aircraft industry and the governmental agencies the so-called thermal barrier shall gradually be pushed ahead.

## APPLICATION

### of Chem-Mill to Airframe Structures

By L. G. Hall
**Supervisor, Engineering Dept.**
**NORTH AMERICAN AVIATION**

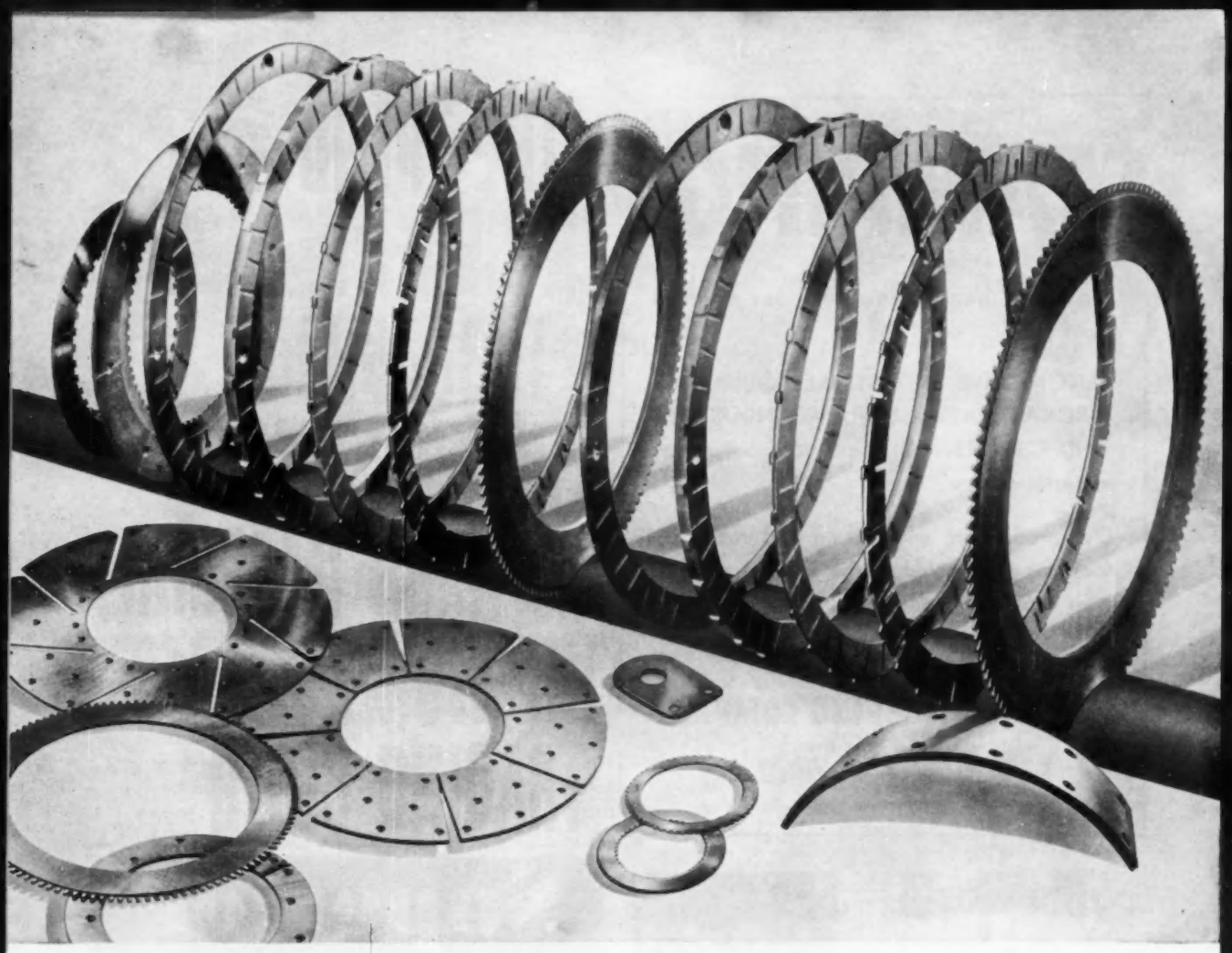
IN comparing the relative costs of Chem-Milling and conventional machining, it is misleading to select any one part as an example and state that it would cost this much to produce by one method and that much by the other.

Chem-Milling and conventional machining should be considered as complimentary, not rival, methods of producing parts. Each has its particular advantages and disadvantages, its obvious potentialities and limitations. These factors should be evaluated when a part is being designed.

In general, it may be said that Chem-Milling can claim the following advantages as far as cost is concerned: Labor rates are lower; tooling requirements are insignificant; investment in capital equipment is less, and incorporation of detail parts into one-piece design can effect a variety of savings in engineering, planning, tooling, and manufacturing.

Aluminum, titanium, magnesium, and many alloy steels may be etched using the Chem-Mill process. The physical and mechanical properties of the stock are not materially altered by the process. Surface irregularities such as dents, scratches, etc., are amplified, and gage variations are reproduced by the process. Tolerances in thickness may be as low

(*Turn to page* 136, *please*)



HOW R/M SETS THE PACE IN FRICTION MATERIAL DEVELOPMENT

# For heavy duty friction jobs: SINTERED METALS

Do you have a friction material application where high temperatures and close tolerances are factors? Or where friction components must be held to a minimum thickness? If so, Raybestos-Manhattan sintered metal friction parts may be an exact answer to your problem.

Under severe conditions like these, organic-content materials wear at an accelerated rate. R/M sintered metals will perform without appreciable increase in rate of wear because of their high thermal conductivity and absence of a destructible bond.

The work done and the heat generated by friction materials are a function of the pressure involved. A reasonable working range for asbestos in dry operation is 25-100 psi. With sintered metals you can go as high as 400 psi.

Remember, however, that R/M sintered metal friction parts are designed for special application requirements. They are intended to *supplement* asbestos woven and molded lines—not replace them. That's why R/M, leader in both the asbestos and metal fields, is in a unique position to help you. Unlike other manufacturers, R/M works with *all* kinds of friction materials. So, you can be sure of a completely impartial, unbiased recommendation on which are best for you when you consult an R/M engineer.

The full depth and breadth of R/M experience—the complete facilities of R/M's seven great plants with their research and testing laboratories—are at your disposal to either develop a special material for your requirements, or to suggest how you can make effective use of R/M material already on hand.

Write now for your free copy of R/M Bulletin No. 500. Its 44 pages are loaded with practical design and engineering data on all R/M friction materials.

R/M FIRST IN FRICTION

THE TRADEMARK THAT SPELLS PROGRESS IN FRICTION MATERIAL DEVELOPMENT

## RAYBESTOS-MANHATTAN, INC.

**EQUIPMENT SALES DIVISION: Bridgeport, Conn. • Chicago 31 • Cleveland 16 • Detroit 2 • Los Angeles 58**

**FACTORIES:** Bridgeport, Conn.; Manheim, Pa.; Passaic, N.J.; No. Charleston, S.C.; Crawfordsville, Ind.; Neenah, Wis.; Raybestos-Manhattan (Canada) Limited, Peterborough, Ontario, Canada

RAYBESTOS-MANHATTAN, INC., Brake Linings • Brake Blocks • Clutch Facings • Sintered Metal Products • Industrial Adhesives Mechanical Packings • Asbestos Textiles • Industrial Rubber • Engineered Plastics • Rubber Covered Equipment Abrasive and Diamond Wheels • Laundry Pads and Covers • Bowling Balls

# STAMPINGS

Produced economically in our modern plant for:

AUTOMOTIVE, INDUSTRIAL EQUIPMENT, AIRCRAFT, AGRICULTURAL INDUSTRIES AND OTHERS; will boost your output at material savings.

Our production, engineering and tool-room facilities are geared to the volume usage of *your* industry.

*Send us your inquiries*

**LANSING STAMPING COMPANY**

1157 So. Penn. Ave.
Lansing 4, Michigan

ESTABLISHED 1914

# THE TREND IN DRAFTING ROOMS THROUGHOUT THE WORLD IS TOWARD IMPERIAL, THE WORLD'S FINEST TRACING CLOTH

Multiform

## BIG BROTHER BENDER

Illustrated above are a few of the many forms that can be produced efficiently on the Multiform Bender.

Model BBB

SMALLER MODELS AVAILABLE

### AIR OPERATED MODELS IN FOUR SIZES

The heavy duty Big Brother Bender is designed for fabricating bus bars, brackets, fixtures, etc., without special tooling. Air controlled with finger tip response. Comes complete with dies, mandrels and wrenches — punching and blanking dies extra. Will punch holes up to 1" and form material up to ¼" thick by 4" wide. We also build smaller models, hand or air operated, for bending materials up to ⅛" x 1½".

*Send for illustrated folder AMI-2*

**J. A. RICHARDS CO.** 903 North Pitcher St. Kalamazoo, Mich.

# Superior

. . . supply and service!

## CORBIN Self-Tightening HOSE CLAMPS

Here's the hose clamp you can depend on, both for ready availability and lasting performance — the CORBIN Self-Tightening Hose Clamp.

First, CORBIN Hose Clamps are always available for immediate delivery in all sizes for hoses from ⅜" to 2⅝" diam.—in any amount you require. Even large emergency shipments are no problem! You're always certain of a smooth-flowing supply for your production lines. Second, CORBIN Hose Clamps are manufactured under "pin-point" quality control methods, from steel wire laboratory-tested to CORBIN's high quality standards. You're always certain of a positive, everlasting seal.

Join America's leading automotive and accessory manufacturers. Get CORBIN — *the* superior hose clamp from *the* reliable source. Write or phone for complete details. Corbin Hose Clamp Div., The American Hardware Corp., New Britain, Conn.

The Original Manufacturer of Self-Tightening HOSE CLAMPS

CORBIN

XXI

*This is the twenty-first of a series of advertisements dealing with basic facts about alloy steels. Though much of the information is elementary, we believe it will be of interest to many in this field, including men of broad experience who may find it useful to review fundamentals from time to time.*

# How Alloy Steels Respond to Induction Hardening

In the now-popular induction-hardening process, steel is first heated above the transformation range by means of electrical induction, then quenched as required. Special equipment is needed, and heat is developed as follows:

High-frequency alternating current passes through a coil or inductor, with the result that a magnetic field is created in the coil. When the piece to be treated is placed in this field, it is heated rapidly by induced energy. With the various types of induction-heating equipment, the process is capable of surface- or case-hardening to various controlled depths; however, through-hardening can be obtained with certain alloy steels. Ferrous metals that respond well to induction hardening include numerous grades of both alloy and carbon steels, as well as hardenable stainless steel and plain or alloyed cast iron.

As a rule, when alloy steels containing no carbide-forming elements are heated by induction, the usual hardening temperatures can be used. But with alloy steels that do contain such carbide-forming elements as chromium, molybdenum, and vanadium, the hardening temperature must be increased if shallow cases are required and the normal effect of the alloying elements is desired.

Hardness obtained by the induction process is a function of the carbon content and prior structure, just as it is when conventional heating methods are used. Nevertheless, higher surface-hardness values for a given carbon content have often been noted in parts subjected to surface induction-hardening. The extra hardness may be as much as five Rockwell C points for steels of 0.30 pct carbon.

As pointed out previously, the induction method requires special equipment. However, it possesses several marked advantages, including speed of heating and cleanliness of operation. Pieces heated by induction are usually subject to a minimum of scaling and distortion. Moreover, induction-hardening equipment is very compact and therefore conserves floor space.

If you would care to know more about the induction hardening of alloy steels, you are invited to communicate with our technical staff. Bethlehem metallurgists have made a thorough study of the subject, including the many details of quenching and tempering. Call them if they can help you in any way. And remember, too, when considering sources of alloy steels, that Bethlehem makes the full range of AISI standard grades, as well as special-analysis steels and all carbon grades.

*If you would like reprints of this series of advertisements from No. I through No. XX, please write to us, addressing your request to Publications Department, Bethlehem Steel Company, Bethlehem, Pa. The first 20 subjects in the series are now available in a handy 36-page booklet, and we shall be glad to send you a free copy.*

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

**BETHLEHEM STEEL**

### Classified Advertisements

AUTO PARTS, wholesale & retail (a chain of 6 stores in Idaho & Oregon). Gross, approximately $800,000. Asking price of $400,000 includes approx. invty. $300,000, and $97,000 equpt! Established 28 yrs. Dept. 24077.

WHOLESALE AUTO PARTS, L. A. County, Calif.—Gross, $60,000. Centr. loc. R.E. (50'x207' in mnfg. ar.) 7000 sq. ft. work area. A-1 eqpt. & accts. Expansion oppty! Retiring. Price, $83,000 plus inv. Dept. 24115.

GARAGE and BODY SHOP, E. New Y. Profits, $10,625. Val. R.E. liv. qtrs. & garage. (3 shops, 1 new, suited to light mnfg.) Expansion oppty. on ideal loc. for car agency. A-1 compl. eqpt. Price $145,250. Dept. 42475.

CHAS. FORD & ASSOC. INC., 6425 Hilywd. Bl., Los Angeles, Cal.

# *Pick exactly the right steel for any job from J & L's complete cold finished line*

## *increased drill life 20% with J & L "1213" steel*

This manufacturer of wrench socket blanks averaged 400 parts per hour when he changed to J & L "1213" steel. Form tool life increased from 10 to 20 hours. Drill life was 20% longer. J&L "1200" steels provide higher cutting speeds, longer tool life. Get facts from your distributor or write to Jones & Laughlin, 3 Gateway Center, Pittsburgh 30, Pennsylvania.

J&L STEEL

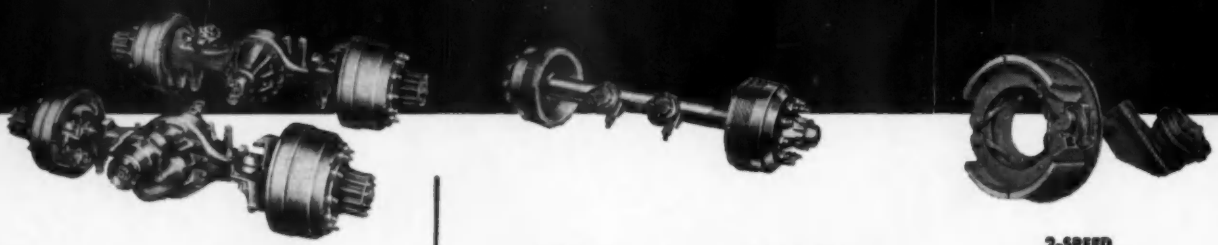
**Jones & Laughlin**

... a great name in steel

MACHINING PERFECTION always starts with the right steel

*For Today's Most Complete Line of Quality*

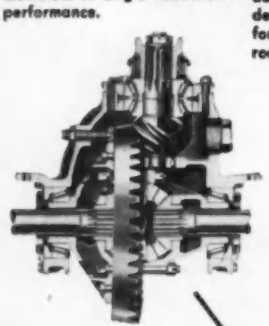
# SPECIFY... TIMKEN-DETROIT®



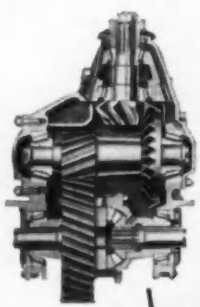
Whatever your requirements for highway or off-the-road equipment—Timken® offers you a full line of driving, trailer and front axles . . . brakes and gear boxes . . . backed by over 50 years of manufacturing experience and proved by field performance and laboratory testing.

One example of the engineering features and superior quality built into *every* Timken-Detroit product is the improved "3 for 1" Letter Series Axle.

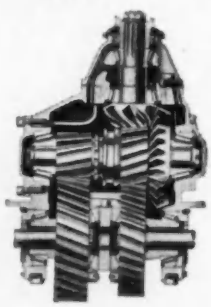
**HYPOID SINGLE-REDUCTION!**
A rugged single-speed power train that provides the very maximum in single reduction performance.

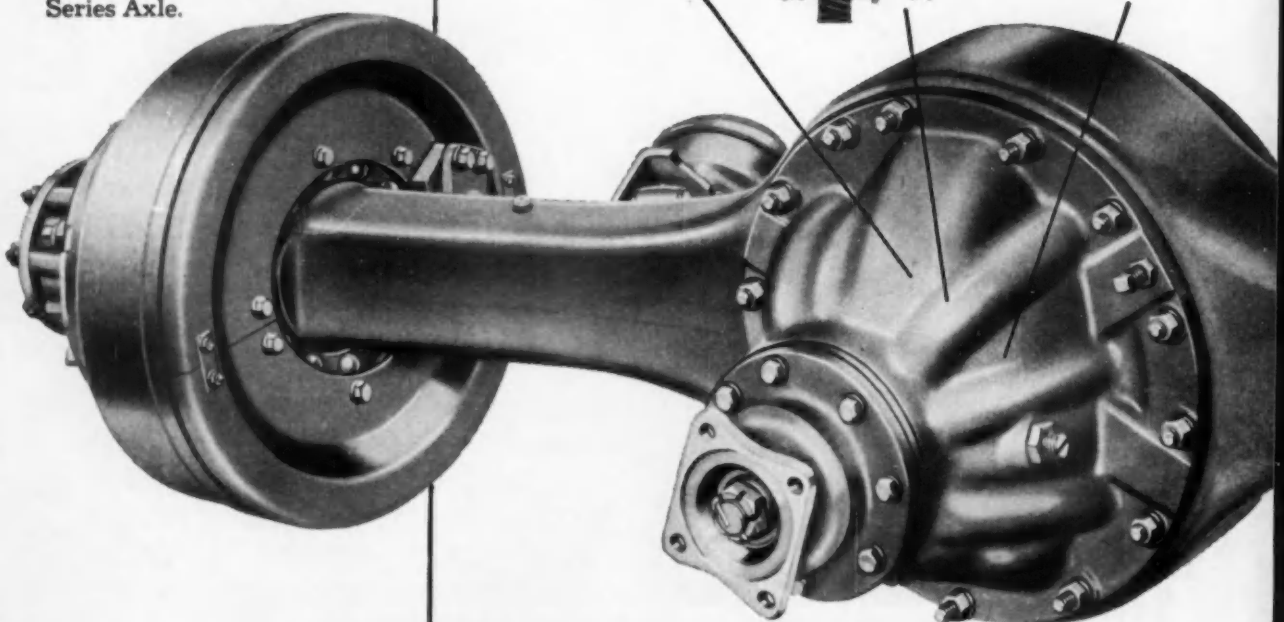


**SINGLE-SPEED HYPOID-HELICAL DOUBLE-REDUCTION!**
This advanced single-speed double-reduction final drive delivers consistently high performance either on or off the road.



**2-SPEED HYPOID-HELICAL DOUBLE-REDUCTION!**
This final drive gives you the most advanced two-speed double-reduction gearing available today.





**WORLD'S LARGEST MANUFACTURER OF AXLES FOR TRUCKS,**

# Axles and Brakes for Commercial Vehicles

Products of

# Rockwell Spring and Axle Co.

## IMPROVED TIMKEN "3 FOR 1" LETTER SERIES
## DRIVING AXLES WILL DO THE JOB BETTER THAN EVER BEFORE!

With the "3 for 1" you gain maximum interchangeability. You have your choice of three interchangeable final drives... using the same housing, hubs, drums, brakes and axle shafts. All parts are standard production items.

Timken-Detroit "3 for 1" Letter Series Driving Axles give you longer operating life . . . lower maintenance cost ...smaller replacement parts inventory.

### Check these "3 for 1" features:

**Improved Hypoid Gears!** Redesigned offset and increased Hypoid gear diameter provide longer gear life, smoother performance, and quieter operation.

**Refined two-speed shift collar and cross shaft!** Improved design gives positive locking action—reduces gear wear and maintenance. Each set of teeth performs but one function, driving or locking.

**Improved torsion-flow axle shafts!** More splines per shaft and increased root diameter give greater torsional strength, longer life.

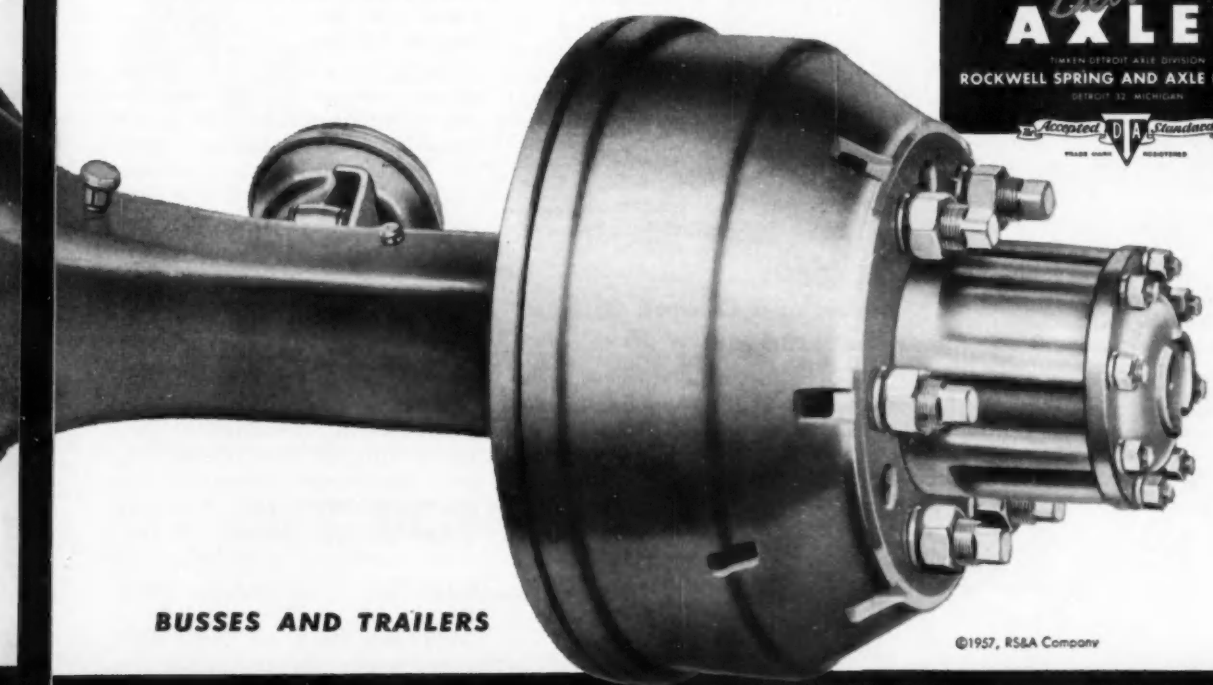
**Famous time-proved differential**—rugged, reliable and smooth! Extra strong gear body and teeth, plus hot-forged trunnion, give long trouble-free operation even under the roughest kind of treatment.

**Hot forged steel axle housing!** The rectangular form of these high-carbon steel housings is the lightest, strongest shape of housing that is available today.

**Improved "P" Series Power Brakes and "DH" Series Hydraulic Brakes!** Available in a complete range of sizes, these advanced brakes offer the most dependable stopping power—lower maintenance cost—easy adjustment and longer service.

Plants at: Detroit, Michigan • Oshkosh, Wisconsin Utica, New York • Ashtabula, Kenton and Newark, Ohio • New Castle, Pennsylvania

TIMKEN Detroit AXLES
TIMKEN-DETROIT AXLE DIVISION
ROCKWELL SPRING AND AXLE COMPANY
DETROIT 32, MICHIGAN
The Accepted D A Standard



**BUSSES AND TRAILERS**

# PRODUCTION

## *Chief Topic*

### *at SAE Aeronautical Meeting*

(*Continued from page* 127)

as ±0.002 plus the actual sheet tolerance.

The Chem-Mill process permits weight reduction. For stiffness, and elimination of parts, etched bands and stiffeners can be produced integrally with the sheet. The process is not recommended for use on castings. The etched fillet radius is approximately equal to the depth of cut.

Panels may be designed with varying depths by progressively unmasking during etching. Chem-Mill may be performed before or after forming. Tapering is possible by proper timing during immersion.

## LARGE

### Light Turbojet Engines

By C. A. Grinyer

Vice-President Engineering and Chief Engineer

ORENDA ENGINES, LTD.
MALTON, ONTARIO, CANADA

THE use of titanium in turbojet engines has permitted an improvement in thrust/weight ratio of a greater magnitude than to be expected by straight material substitution. This is because the use of titanium in rotating parts permits the use of a two bearing rotor system with elimination of center bearings. Furthmore, with smaller dynamic forces the engine structure can be correspondingly lighter.

Small turbojet engines, despite their slightly higher bare thrust/weight ratio are not competitive with large engines for large aircraft, for one or more of the following reasons: higher installed weight, inferior performance, installation and control complication, higher cost per pound of thrust.

A bypass engine and turbojet of the same specific thrust have about the same specific fuel consumption. In addition to having a lower turbine operating temperature, the turbojet of the same specific thrust is no noisier. Moreover, the turbojet can be overspeeded giving a thrust reserve of about 30%.

In order to operate over a wide speed range at maximum rpm with maximum combustion temperature indicates a small compromise in subsonic performance which would appear to be the desirable alternative to variable turbine geometry.

High speed aircraft using afterburning have to accommodate bypass flow for intake matching and cooling flow for the afterburner. The use of a lightweight ejector nozzle fulfills this purpose and also permits satisfactory divergent expansion within the range of exit diameter to engine diameter likely to be used in practice.

Higher turbine inlet temperatures are most beneficial in non-afterburning engines. For high speeds because of high compressor delivery temperatures, the use of air cooling of turbine blades becomes limited and the development of other methods of cooling or of materials, which do not require cooling, is necessary.

# METALS

(*Continued from page* 102)

that without Government buying the prices of both metals would have weakened before now.

This is convincingly shown by last year's statistics, which disclosed that out of a total slab production of over one million tons about 15 per cent went to the stockpile. As a result, producers' stocks were held to a modest increase of 27,300 tons at the year-end. Otherwise, stocks would have become so heavy that price cuts would have been mandatory.

Lead is in a better statistical position. Demand has been quite good from the cable manufacturers for sheathing. It has been off for replacement batteries because of lower automobile production, but it is improving. It also appears that the newer and more powerful batteries have a longer life. An official of St. Joseph Lead Co. estimates that lead consumption in U. S. in 1957 should be about the same as last year.

## Aluminum Offered to Government

No significant improvement has appeared in the aluminum industries, but primary producers seem unworried. However, there is no longer any hesitancy in offering metal to the Government under the "put" clause of agreements, whereby about two-thirds of the output of the expanded facilities must be taken by Washington if the metal cannot be sold on the market. Over 200,000 tons thus far this year have been "put" to the Government, which puts this tonnage into storage and relieves pressure on the market. Nothing has been heard of a price reduction from a present level of 25¢ a pound for pig.

## Tin Price Steady, Consumption Unchanged

The tin price continues to hold around 99¢ a pound (New York), which has been unchanged for some time. It compares with an average of $1.01 in 1956. This steady price reflects the activities of the manager of the International Tin Agreement. He is authorized to buy or sell metal from the buffer stocks when certain price limits are reached. The floor price at which he can buy has recently been raised to 91 cents a pound from 80 cents but his selling ceiling remains at $1.10. The effect is mildly inflationary.

In essence, the tin industry's problem is not one of over-supply, but under-consumption. Last year's world consumption was around 157,000 tons, almost exactly the average consumption for the five years preceding the war. Consumers appear assured of adequate supplies at prevailing price levels for the foreseeable future.

# Index to Advertisers

This Advertisers' Index is published as a convenience, and not as part of the advertising contract. Every care will be taken to index correctly. No allowance will be made for errors or failure to insert.

# $21 for a sales call —but how many dollars worth of SELL?

Recent surveys show that the average cost of a sales call is approximately $21. Costs in your company may be somewhat more or somewhat less—but the important question is "How much SELL are you getting for your sales call dollar?"

You are not getting full value unless you are giving industrial advertising a chance to do its proper share of the sales job—making continual contacts, arousing interest, creating preference for your company and its products.

If advertising is doing this part of the job, your salesmen can concentrate on the "climax steps" of selling—showing the prospect what your products will do for him, and getting his order.

The salesman always "carries the ball," but he gains more ground when a well-balanced advertising program "runs interference" for him.

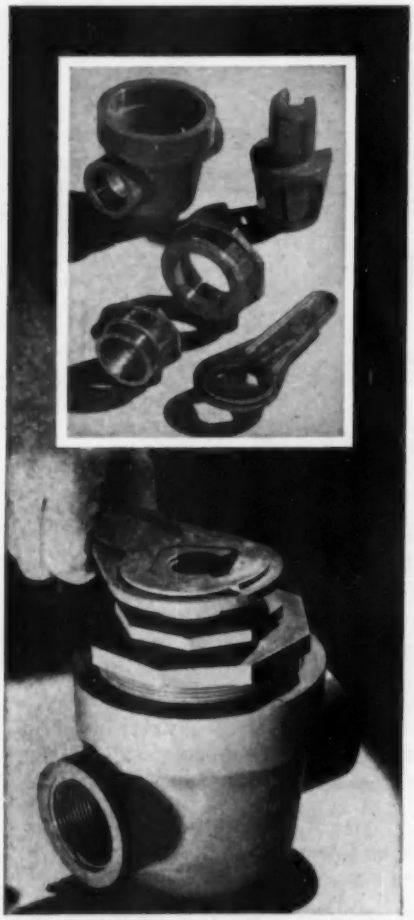
**NATIONAL INDUSTRIAL ADVERTISERS ASSOCIATION, INC.**

*271 Madison Avenue, New York 16, N. Y.*

An organization of over 4000 members engaged in the advertising and marketing of industrial products, with local chapters in ALBANY, BALTIMORE, BOSTON, BUFFALO, CHICAGO, CLEVELAND, COLUMBUS, DALLAS-FORT WORTH, DENVER, DETROIT, HAMILTON, ONT., HARTFORD, HOUSTON, INDIANAPOLIS, LOS ANGELES, MILWAUKEE, MINNEAPOLIS-ST. PAUL, MONTREAL, QUE., NEWARK, NEW YORK, PHILADELPHIA, PITTSBURGH, PORTLAND, ROCHESTER, ROCKFORD, ST. LOUIS, SAN FRANCISCO, TORONTO, ONT., YOUNGSTOWN.

*News about*

# B.F.Goodrich Chemical *raw materials*



**PLUG VALVE** *of Geon for handling corrosive fluids demonstrates molding of complicated shapes with integral threads. At the bearing surfaces Geon is molded to another plastic.*

## LOOK WHAT THEY'RE MOLDING IN GEON RIGID VINYL...

*All parts shown made by Tube Turns Plastics, Inc.*

Geon polyvinyl chloride rigid compounds are recognized as outstanding materials for piping and fittings. Geon offers high impact and tensile strength, and superior resistance to oils, acids, alkalis, and most chemicals.

These same rigid compounds are being molded into many complicated shapes and parts in addition to piping components. Geon can be used in designs utilizing very thin sidewalls as well as heavy sections. Holes, studs, and threads can be made integrally. Parts weighing several pounds can be molded in one shot.

Despite design complexity, check Geon for strong, light, corrosion-resistant parts. For booklet on properties of rigid Geon compounds 8700A and 8750, write Dept. FZ-3, B. F. Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ont.


**B.F.Goodrich Chemical Company**
**a division of The B.F.Goodrich Company**

**BIG FELLOWS** *include piping tee and motor housing, requiring heavy cross section, chemical inertness, dimensional stability. By contrast, molding for automobile dashboard has thin section, large projected area.*

**ELECTRICAL PARTS** *include fractional horsepower motor housing which reduces appliance weight, and hanger band for transformer with Geon molded around metal bolt. Geon has excellent dielectric properties.*

**AUTO HORN** *trumpet shows complicated contours possible in rigid Geon. Note very thin walls obtained in this high-impact material. Photos courtesy Tube Turns Plastics, Inc., Louisville, Ky.*

**B.F.Goodrich** GEON polyvinyl materials • HYCAR American rubber and latex • GOOD-RITE chemicals and plasticizers • HARMON colors

# CLEAR-O-MATIC*

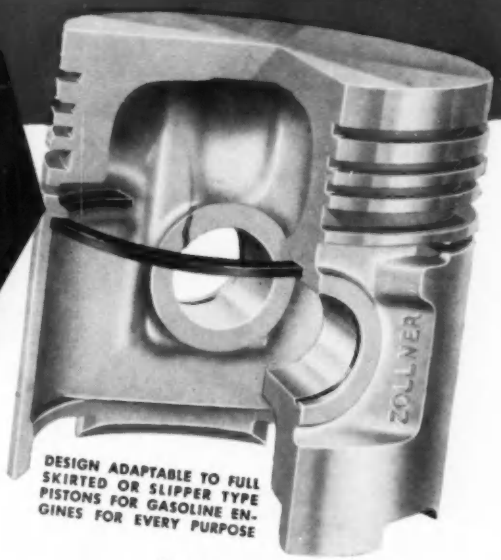
## The All-Temperature Piston

**UNIFORM SKIRT CLEARANCE FROM 20° BELOW ZERO TO 200° F**

**STEEL TENSION MEMBER**

Anchored only at pin bosses and cast in positive contact with I.D. of piston skirt

Controls Clearance Automatically

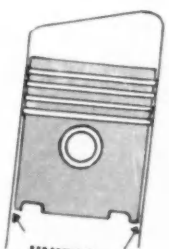



DESIGN ADAPTABLE TO FULL SKIRTED OR SLIPPER TYPE PISTONS FOR GASOLINE ENGINES FOR EVERY PURPOSE

## Sensational Performance

### Requires less than .001 Clearance

Cold or Hot, Clear-O-Matic Piston clearance stays constantly uniform. Required clearance is reduced to less than .001. This great development of the "All-Temperature" Piston by Zollner engineers provides another fine feature attraction for the modern motor car . . . smooth, quiet running engine . . . no cold slap . . . reduced friction without loss of durability or heat conductivity . . . no danger of scuffing or seizing. We suggest a test of these sensational performance advantages for your engine.



UNIFORM EFFECTIVE SKIRT CLEARANCE AT ALL TEMPERATURES

1. Clearance maintained uniformly at all coolant temperatures from 20° below zero to 200° F.
2. Effective expansion identical with ferrous cylinder.
3. Steel tension member, with same effective expansion as cylinder, maintains uniform skirt clearance through entire temperature range.
4. Normal diametric clearance usually less than .001 with uniform skirt bearing.
5. Durability and conductivity comparable to heavy duty design.

*T.M. Reg. Pat. App. For

ADVANCED ENGINEERING

PRECISION PRODUCTION

COOPERATION with Engine Builders

ZOLLNER PISTONS

THE ORIGINAL EQUIPMENT PISTONS

ZOLLNER

ZOLLNER · Fort Wayne, Indiana

# FACTS

about

## NEW DEPARTURE BALL BEARINGS

## EASIEST HAULING
## LEAST MAINTENANCE


In this wheel bearing the seal is contained inside the bearing and makes perfect contact with the smooth-finished inner ring.

Heavy wagon or implement wheels on these New Departure ball bearings not only give the farmer the *easiest*, freest-rolling mounting—they require *no adjustments, no periodic greasing*. The farmer need never give them a thought!

And the mount is a honey for simplicity—no adjusting nut, no spindle threads, no separate seal to fit!

These New Departure ball bearings, thoroughly proved in high-production automotive wheels and other applications, are pressed in the hub. The hub is slipped over the spindle and retained by a snap ring—*fast, economical, simple!*

You'll find your New Departure Sales Engineer will gladly give you complete details.

**VISIT NEW DEPARTURE AT THE DESIGN ENGINEERING SHOW, COLISEUM, NEW YORK CITY, MAY 20-23, SPACE 1240**

SEE "WIDE WIDE WORLD" SUNDAYS—NBC-TV

**BALL BEARINGS MAKE GOOD PRODUCTS BETTER**

NEW DEPARTURE • DIVISION OF GENERAL MOTORS • BRISTOL, CONN.